SCIENTIFIC AMERICAN

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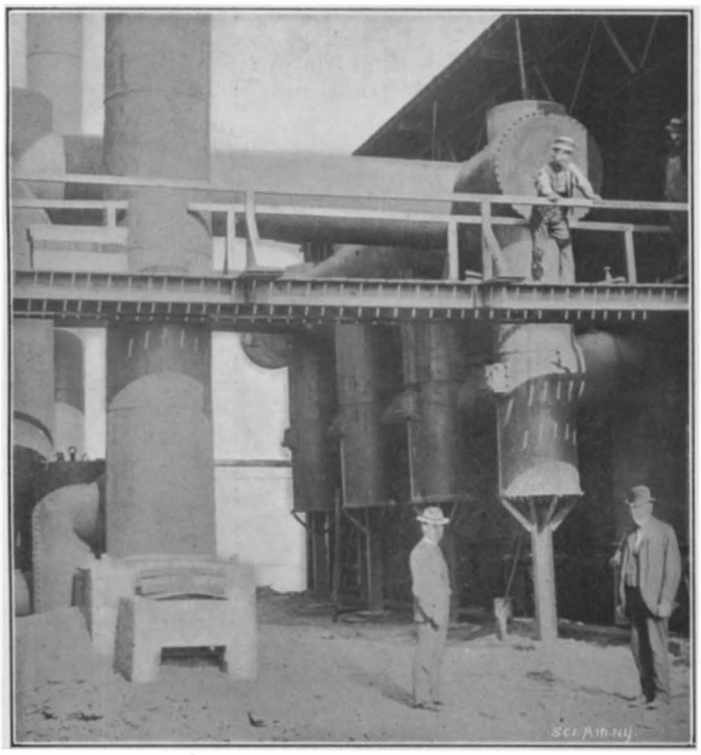

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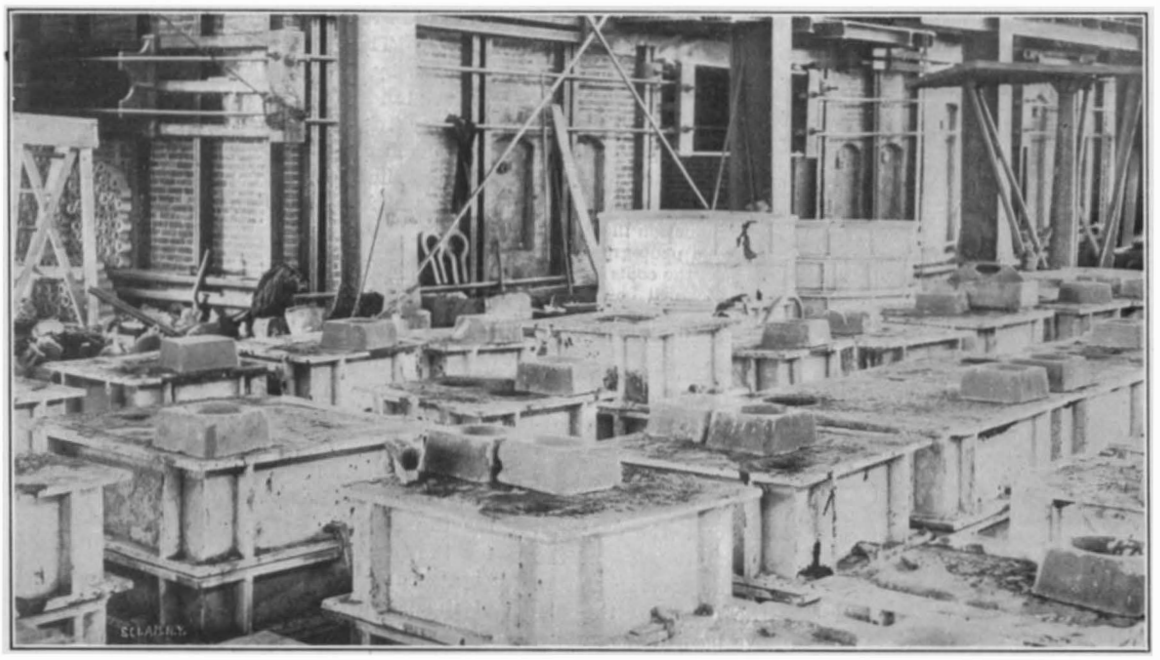

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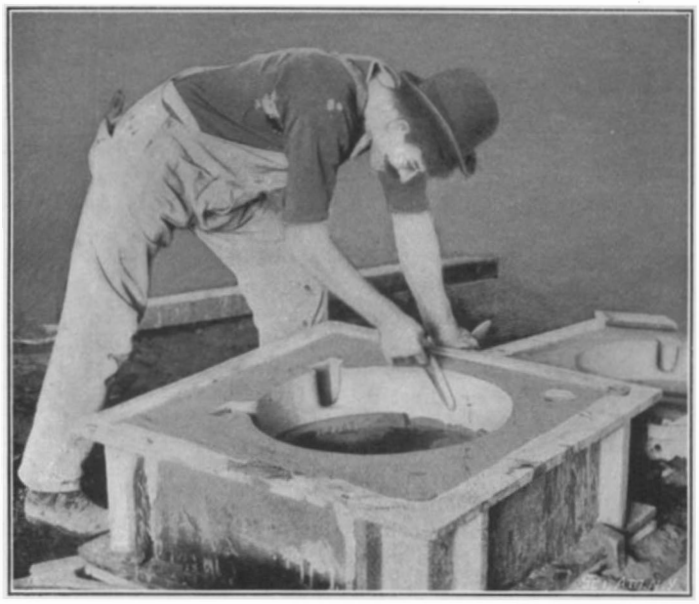

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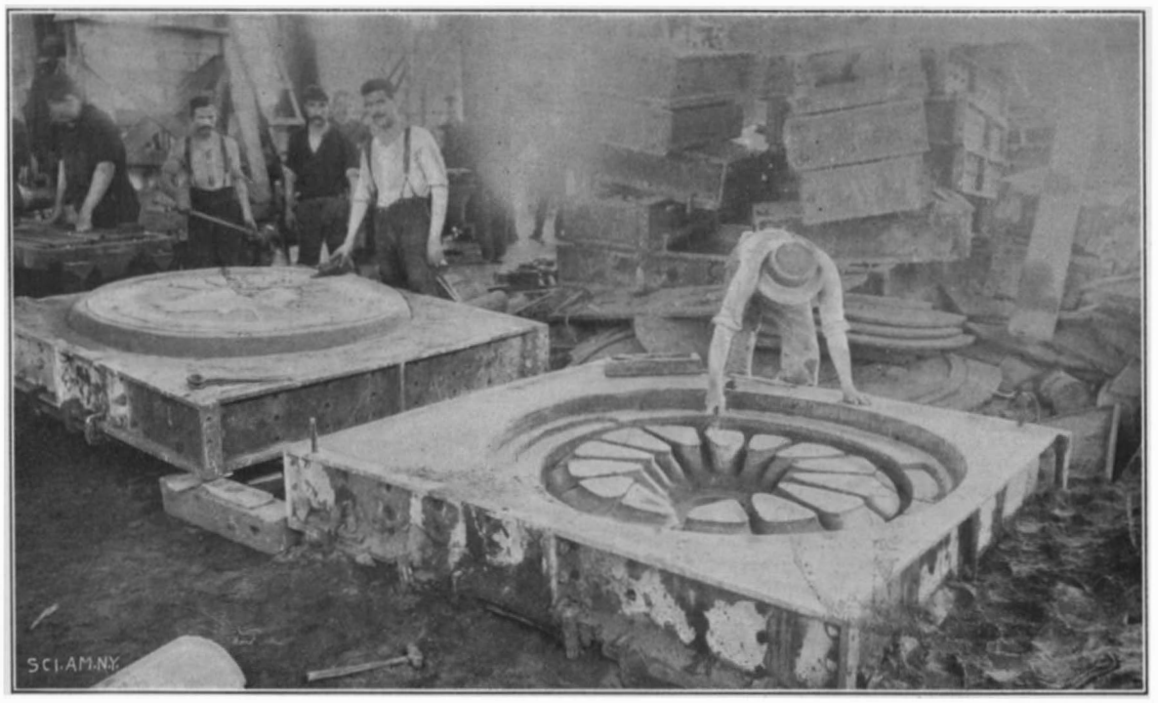
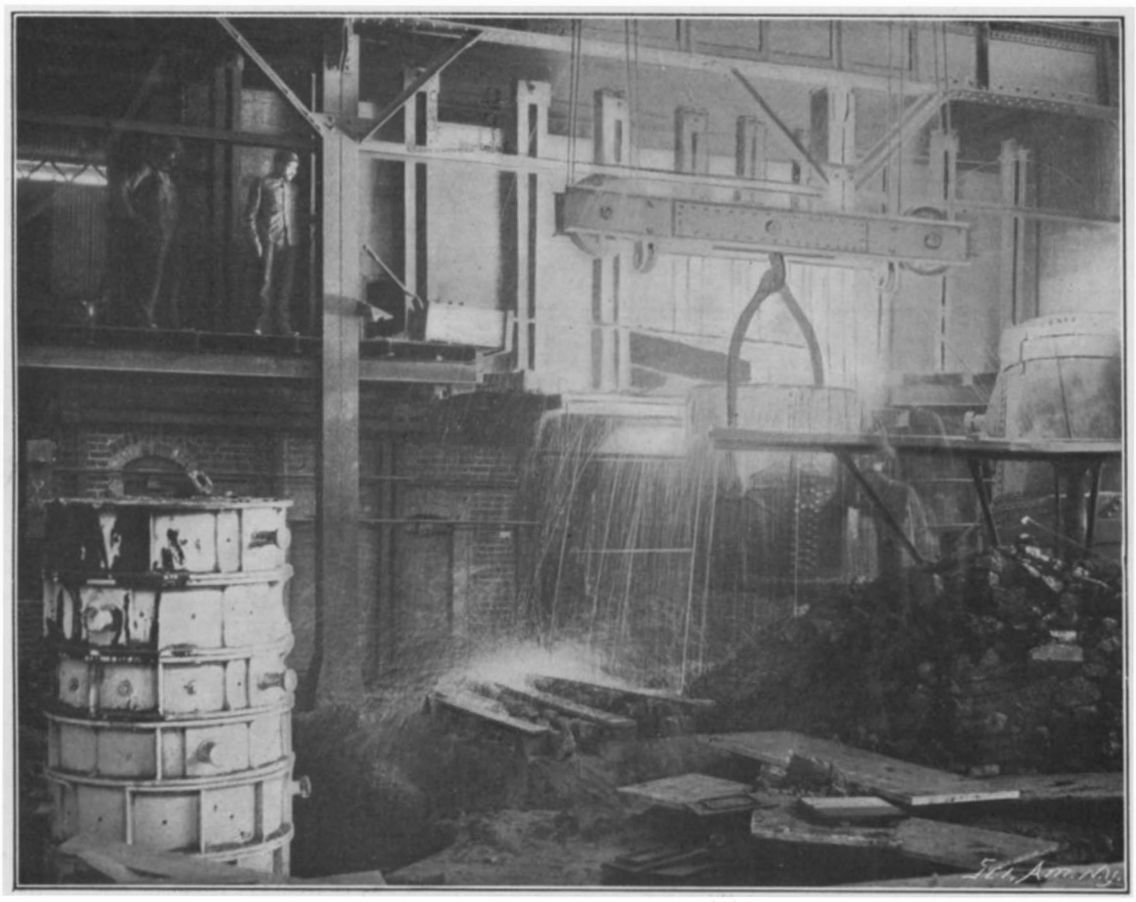
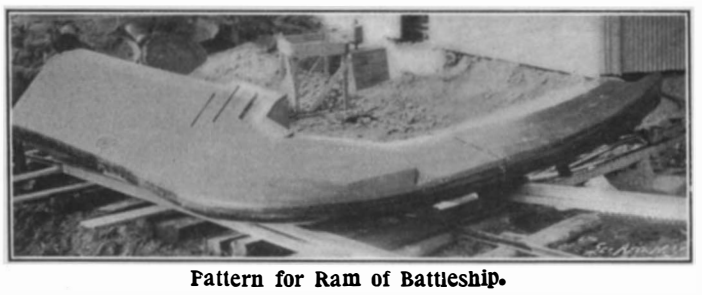


Finishing Mould for Locomotive Driving Wheel.



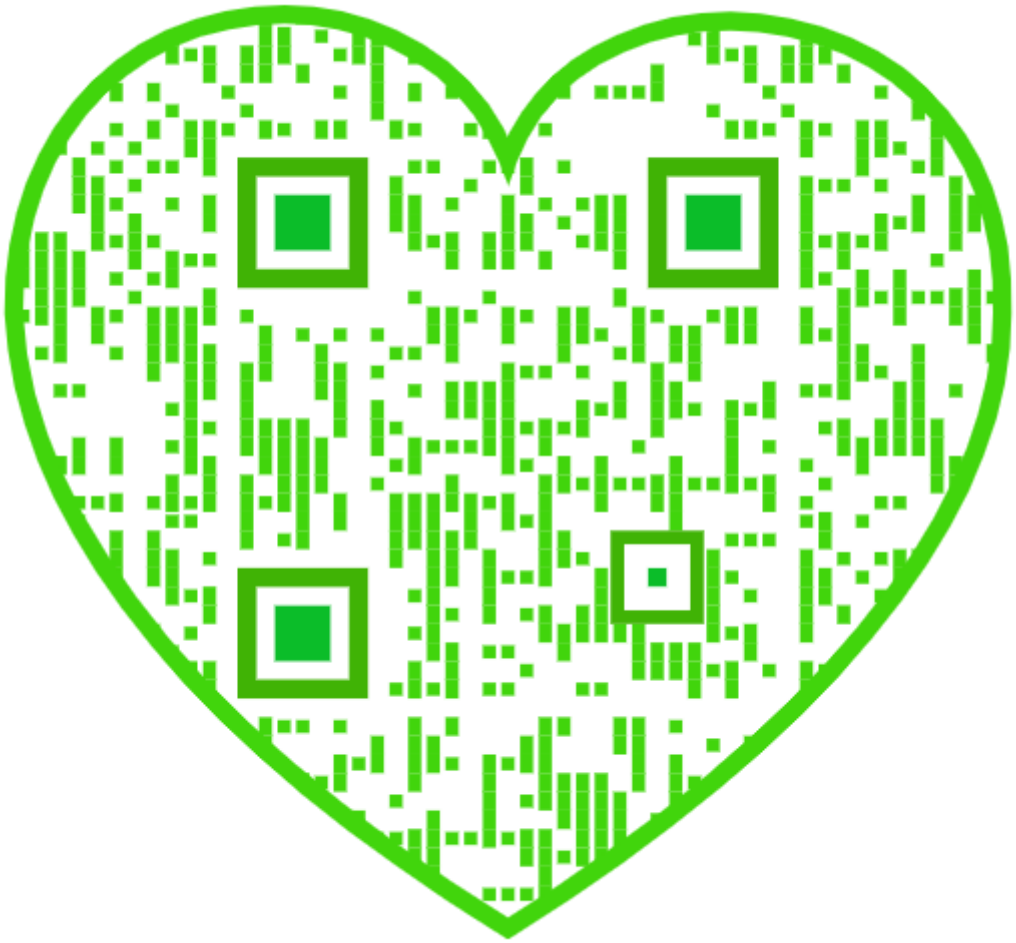
Pouring Molten Metal into Ladle.



Pattern for Ram of Battleship.

Cleaning Castings by Sand-Blast.

THE MANUFACTURE OF HIGH-GRADE CAST STEEL.—[See page 230.]



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NEW YORK, SATURDAY, OCTOBER 12, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE LOSS OF THE "VIPER" AND THE "COBRA."

It is an extraordinary coincidence that, out of nearly two thousand torpedo boats and torpedo-boat destroyers belonging to the navies of the world, the only two that were driven by turbine engines should have been wrecked within a few weeks of each other—the "Viper" running upon the rocks, and the "Cobra" foundering in a heavy gale. On the face of it, the coincidence would seem to point to the turbine motors as being directly or indirectly the cause of the disasters; but as far as the facts have been made public, there is no positive evidence that they were even indirectly contributory to the loss of these valuable and phenomenal boats. The "Viper" was wrecked when running at high speed among the sunken rocks of one of the most dangerous stretches of water in the world. The rise and fall of the tide among the Channel Islands, where she was wrecked, amounts to 40 feet, and the tides sweep across the track of vessels steaming from these islands to the English coast at a velocity which in places reaches as high as 7 knots an hour. The list of casualties in these waters is a long one, and where the experienced captains of the regular Channel Island steamers have so often lost their ships, a naval officer less acquainted with the currents might easily be carried from his course and strike one of the many sunken rocks.

The "Cobra" seems to have been wrecked by breaking in two when she was being driven against a gale, and it is possible that the desire to make a record trip on the trial run led to the frail vessel being driven too fast into the head seas, with the result that her back was broken.

In each case the disaster seems to have been due to poor navigation, and the fact that both vessels carried turbine engines proves nothing against the new system of propulsion.

At the same time, the fact remains that for marine purposes the turbine engine is severely handicapped by its inability to go astern; and in the three turbine vessels that have been built, smaller auxiliary turbines are fitted for this purpose. This offsets, to a certain degree, the high efficiency of the turbine installation; yet, so great is the saving of weight that, even with reversing motors on board, the total weight of the motive power is only about 66.5 per cent, for a given horse power, of that required in reciprocating engines.

THE TANDEM COMPOUND LOCOMOTIVE.

Interest in the compound locomotive has been quickened by the success of a new type of locomotive built by the Schenectady Works, in which the pair of high and low pressure cylinders on each side of the locomotive is arranged in tandem, the high-pressure cylinders being placed in front of the low pressures and on the same axial line, a common piston-rod carrying the two pistons. This arrangement involves the use of four cylinders, in which respect the type corresponds to the well-known Vauclain system, which carries the two high-pressure cylinders above the low pressures, the two piston-rods on each side connecting to a common crosshead.

Although the compound locomotive has not met with the favor or made the advance in this country that it has abroad—and particularly in France, where the fastest trains are hauled by four-cylinder compounds, —the best designs of compounds that our shops have turned out have fully justified the claims of fuel and steam economy which are urged in favor of the compound as compared with the simple high-pressure type.

The disposition of our builders to preserve the simplicity which has been one of the excellent features of American locomotives led them to favor, in the earlier compounds, the two-cylinder type, an arrangement which conformed closely to the ordinary two-cylinder simple locomotive. The recent growth in size of locomotives, however, has necessitated increasing the low-pressure cylinder to a diameter which cannot be accommodated by the width of the tunnels and clearance of station platforms. Hence the use of four cylinders has become a structural necessity, to say nothing of the more advantageous distribution of weights.

Assuming four cylinders to be a necessity, the question is one of their location. In England and France, they have been arranged to work on four cranks, two outside and two inside the frames. In this country, with our traditional dislike to inside cranks, we have preferred to place all four cylinders outside the frames. The Vauclain system has proved its good qualities by ten years of service, and the new experimental tandem locomotive, built by the Schenectady firm for trial on the Northern Pacific Railway, has given such satisfactory service during the past twelve months, that an order for twenty-six more has been given, and forty have also been ordered for the Atchison, Topeka & Santa Fé Railway.

SOME OF THE ENGLISH ROYAL TREASURES.

In the forthcoming coronation of King Edward VII. of England there will be a display of royal treasures that has seldom been brought together at a single function in recent years. It is so long since England has had a coronation that not many of the people remember the exact amount of royal treasury stock in the shape of jewels, crowns, and scepters kept on hand. It will be an interesting inventory time for the English nation, and not a few will find out for the first time the magnificent collection of jewels kept securely in the Tower. A good deal of the value of the English regalia is due to the historic associations connected with the various pieces. The crowns and scepters that have been worn by many successive kings naturally have a value in the eyes of the people far above their actual intrinsic worth.

There is quite a difference in actual worth between the early crowns of England's monarchs and those of later date. Probably Queen Victoria's imperial crown was the most expensive ever made. King Alfred's crown, which long ago disappeared, was mentioned in early works as being worth £248 10 shillings. Compare with this Queen Victoria's magnificent crown, so sparkling with brilliants that the crown itself is scarcely visible. There are by actual count 2,783 diamonds in this crown, some of which are large, handsome stones, and others mere chips, but all cut and set to form a complete picture of wonderful brilliancy. In addition to the diamonds there are 277 pearls, 16 sapphires, 11 emeralds, and 4 rubies, besides one large ruby and sapphire of remarkable value. This large ruby is the great spinel ruby which belonged to the Black Prince in 1367, and it has been said to be worth £100,000. The big sapphire is also an historical gem of almost priceless value. It was the one worn in a ring by Edward the Confessor and buried with him at Westminster. These two stones alone make the crown of both historic and intrinsic value far beyond that of any other crown in existence.

This crown is of more recent construction than the other imperial regalia, and it shows its modern workmanship in the setting of the stones. Most of the royal treasures used for the coronation and state occasions were made in 1662. At the time of the Commonwealth all the crowns and royal regalia were destroyed except the golden pitcher used for holding the anointing oil, the golden spoon, and the ancient coronation stone. After the restoration all the ancient articles were remade by Sir Robert Vyner, the royal goldsmith. His work testifies to his skill as a goldsmith, and no jeweler since has been made as famous because of the fact he received the royal commission to restore the destroyed regalia. His ambition was to imitate as closely as possible the ancient relics. For this purpose he studied the old coins and great seals of former kings to get the idea of the orbs, scepters, and crowns. The ancient style of the jeweler's art was to set many of the jewels with enamels on gold open work. This style of work is particularly manifest on the scepters, where enameled and jeweled scrolls are the chief ornaments. The champlevé enamel on the royal bracelets represents good work done in the days of Sir Robert Vyner, but there is also some sign of recent touching up by modern goldsmiths.

Queen Victoria's imperial crown represents the highest skill of modern stone setting, and from the point of view of the diamond cutter it is said to be the perfection of design. It required a good deal of artistic skill to set so many stones in a crown of that size without ruining the effect as a whole. In fact, the setting of the stones is so light and carefully done that one is scarcely aware of the background. The setting is of silver, and the pearls are held with gold wire. The rim of the crown is not a solid metal ground, but the gems are arranged in clusters in open work. The effect is consequently very striking.

St. Edward's crown is the official crown of England, and this shows very different work from Queen Victoria's. The latter was made in 1838 by Rundell & Bridge, and the former in 1662 by Sir Robert Vyner. The official crown is of great size, and almost clumsy looking compared with its mate. The rim is of solid gold, and edged with rows of pearls of considerable size, with here and there clusters of colored jewels surrounded by diamonds and set on enamels of red and white. The effect of so many colors in the rim gives a rather brilliant aspect to the crown, especially in a light. The four crosses patées and fleurs-de-lis which rise from the rim and form an arch toward the center are likewise studded with diamonds and colored jewels set in red and white enamel. In fact, this whole enamel effect is apparent in every part of the crown, and shows to perfection the old method of setting stones. Even the center orb of gold is filled with stones, with enamel effects. From the center orb the cross patée rises upward and is tipped off with a large pearl and with extended arms containing drop-shaped pearls. On the whole the crown is very striking, though somewhat clumsy, and a good representative of the goldsmith's art of nearly three centuries ago.

The orbs and scepters of the royal regalia which are deposited in the Tower and brought out only for coronations, are fully as interesting as the crowns, for though dating no further back than 1662, they possess sufficient historical association to make them of great value to the English people. They are symbolical of times and personages which will forever live in history. There are two orbs in the collection made for monarchs in the past. The first and larger one was made by Sir Robert Vyner for Charles II. and the smaller one for Queen Mary II. The first has consequently always been accepted as the official one by the English people, and every monarch since has been crowned with it. The orb is held in the hand at the coronation, its distinctive meaning being of rather obscure Christian origin, borrowed evidently from the Roman emperors by the early Saxon kings. In the great seals of the early Saxon kings the monarch is represented as holding a simple sphere or orb in his left hand, and in some a cross and a dove surmount the orb. From the earliest time the orb has thus been representative of the sovereign, and all succeeding orbs have been imitated after these early ones. They have varied somewhat in ornamentation since Edward the Confessor's time, but in the main they retain the cross-and-dove effect.

Sir Robert Vyner, under instructions from King Charles II., made the official orb of 1662, which is in use to-day, six inches in diameter, with a fillet around the center surmounted with an arch and edged with pearls. Clusters of colored jewels and diamonds stud the band and the arch, while the red and white enamels inevitably appear. At the top of the arch is a fine amethyst cut in facets one and a half inches high, and on this stands the cross patée, edged with rose-cut diamonds. In each of the four corners of the cross is a large, handsome pearl, while at the foot there is a collar of diamonds.

The smaller orb of Queen Mary is made somewhat after the same pattern, but it is smaller and more delicate, yet ornamented with fully as many jewels and diamonds. The fillet of gold around the center is outlined with large pearls and handsome amethysts, sapphires, and diamonds. The small cross at the top is simply decorated with precious stones. This orb belongs to the royal regalia, and is kept with jealous care in the Tower. Though it is not the official one, it generally figures in every coronation.

There are also two scepters in the royal collection, either one of which is a superb piece of the goldsmith's art. The royal scepter with the cross is two feet and nine inches in length, while Queen Mary's scepter, made for her by King James II., her husband, is two feet and ten inches in length. The latter is of solid gold, and ornamented only with diamonds. The former is of gold, but very elaborately decorated and ornamented with colored jewels. The upper portion is wreathed and twisted, and very handsomely decorated. There are three white and red enameled bands dividing the scepter. The cross rests on an orb of gold, and a large amethyst stands on it, faceted and held in position by jeweled projections. The whole piece is studded thickly with costly gems, and the effect is brilliant in the extreme. This is one of the finest products of Sir Robert Vyner's art. Some parts of this scepter have been remade since the time of Vyner, but the part which represents his work is easily recognized from the later additions.

There are only three articles of the regalia that date back to a period more remote than the restoration. These three articles were in Westminster Abbey at the time the Commonwealth ordered the destruction of the royal treasures, and they escaped. One of these is the ancient coronation stone. The other two are the only royal treasures produced by the goldsmith's art to recall a very great antiquity of workmanship. They are the golden eagle or ampulla, and the coronation spoon. The eagle stands on a pedestal,

and measures from the base upward nine inches, and weighs, all told, ten ounces of solid gold. The head of the eagle unscrews, and a hole in the beak permits the oil to pour forth upon the royal head. When this golden eagle was made history does not definitely say, beyond that it was in use at the coronation of Henry IV., in 1399. From general appearances, however, it looks as if Vyner had made some recent changes and improvements upon it. Certainly parts of the eagle have been worked over in recent times with a chasing tool. The screw which holds the head in position is hand-made, which partly testifies to its remote antiquity.

The coronation spoon is thought also to have been made some time in the twelfth century, and its style of ornamentation appears to prove this. The spoon is of silver gilt, and has a curious rib down its center, dividing it so that it fits the two fingers of the right hand. The ornamentation is that known as champlevé, a form of preparing metals for enameling in vogue centuries ago. There are four pearls in the handle, but otherwise its ornamentation is simple and inexpensive. There are indications that Vyner, when he remade the royal regalia for Charles II., also touched up the spoon, especially the bowl part, which indicates a later style of goldsmithy than the handle.

G. E. W.

EXTENSIVE PROJECT FOR IRRIGATING EGYPT.

BY ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The English government is determined that barren Egypt shall be restored to its ancient fertility. A few weeks ago we published in the columns of the SCIENTIFIC AMERICAN a description of the irrigation works that were being carried out at Assiout and Assouan, on the Nile. Now that these two projects are rapidly approaching completion, the English and Egyptian governments are surveying the country to ascertain where similar projects might be profitably and successfully carried out. Sir William Garstin, the Egyptian Under Secretary for Public Works, has had charge of these surveys, and for the past three years has been busily engaged in studying the White Nile and its various affluents. He has now prepared and forwarded his proposals for various irrigation works to the English Foreign Office.

By the end of the present year something like $35,000,000 will have been expended upon irrigation works and drainage works on the Nile since 1885. The barrage at Cairo, which was designed by a well-known French engineer, but was insecurely constructed, cost $2,300,000 to be restored, and to be converted into a serviceable work. Subsequently, to enable more water to be stored, two weirs were constructed below the barrage, at a cost of another $2,430,000. The result of this section of the work has been the doubling of the cotton crop of lower Egypt, equivalent to a gain of approximately $25,000,000 per annum to the country. The expense incurred by this undertaking has been thus adequately refunded.

Upon the various works in connection with the delta of the river in the eastern provinces, a sum of over $3,350,000 has been spent. This section of Egypt is one of the most fruitful and most important portions of the country. The building of these numerous miscellaneous works has been attended with great success, and has proved of inestimable service to the country.

For the purpose of insuring a supply of water to Sharaki lands in years of low flood about $3,660,000 has been spent. This part of the work is practically completed, and the extent of its utility may be adequately gaged from the fact that after 1899 only 264,000 acres of land were left without water, whereas in 1877, when the flood was not so low as in the later year, over 800,000 acres of water-land were without water.

Drainage works have absorbed $5,000,000. Large tracts of land, which formerly were so heavily waterlogged as to be absolutely useless for agricultural purposes, have been efficiently drained and now raise good crops. The arrears of taxation, which formerly attained a high figure, have also been greatly reduced.

The Assiout and Assouan dams, which were described in the SCIENTIFIC AMERICAN of May 4, will be completed in 1902. The latter dam will store up the water after the flood has passed, and will increase the supply of the river in the summer. A great portion of the extra water will be devoted to the transformation of the basin lands of Middle Egypt, which at present raise a flood crop only. Pumping stations are to be erected to facilitate and to extend the cultivation of the sugar cane. These works will also enable a tract of land in the Fayoum Province, which is at present an arid barren waste, to be cultivated.

The foregoing is an epitomé of the irrigation works at present in hand. Lord Cromer calculates that the irrigation part of them should be paid for within the next two or three years. But even when these works are completed, Mr. Willcocks, the eminent civil engineer, who has made the irrigation of the Nile his special study, estimates that the country will still require 2,610,000,000 cubic meters of water every year, while Sir William Garstin is inclined to think this an underestimated quantity, and that over 4,000,000,000 cubic meters of water will be necessary. The question that arises is: Whence can so large a quantity of water be obtained? Sir William has two alternatives. A reference to the map of the lower Nile shows that at Khartoum the river bifurcates—one tributary, the White Nile, proceeding from Victoria Nyanza and Albert Nyanza, and the other, the Blue Nile, rising from Lake Tsana, in Abyssinia.

The area of Lake Victoria is approximately 70,000 square kilometers. If the level of this lake were raised but one meter, 70,000 millions of cubic meters of water would thus be stored, while if the level were raised by three meters, the quantity of water stored, after deducting loss by evaporation, would amount to at least 140,000 million meters cube. The first estimate, however, would supply more than sufficient water for the whole of the Soudan and Egypt. There is one disadvantage of damming the water of this lake. The shores are thickly populated, the native townships and villages stretching right down to the water's edge. Therefore, in the rainy season the water that was being dammed back would flood the villages and cause widespread inconvenience. Also, about one-half of the area of this lake lies within German territory, and naturally the Germans might object to the raising of the water-level of the lake.

With the Albert Nyanza, the case is entirely different. This lake has a superficial area of about 5,000 square kilometers. Sir William Garstin suggests that, by the construction of a regulating dam at a point on the river below its exit from the lake, water could be stored up in the lake during the rainy season and utilized during the dry season to maintain the river at a higher level. The lake has an extensive catchment area, and he considers that its level could be raised without much difficulty to the required height. There are one or two objections, however, which considerably militate against the realization of the scheme at this point. The principal is the frequent seismic disturbances to which this part of the country is liable. Then, also, objections might be raised against constructing large works in such a remote district, since no one who is familiar with the country through which the White Nile flows, would embark upon any extensive irrigation projects to render the country agricultural.

Sir William Garstin then deals with Lake Tsana as the most practicable means of solving the difficulty. This sheet of water, which has a superficial area of about 3,300 square kilometers, is situated high upon the plateau in Abyssinia. The lake is deep, and its shores are uninhabited, so that no ill-effects would result in raising the water-level. If the water-level of this lake were raised five meters, a storage of 132,000,000,000 cubic meters of water could be obtained after allowing the necessary deduction for loss by evaporation. This basin is far more suited for extensive irrigation purposes than the Albert Nyanza. The scheme would not present any abnormal engineering difficulties, and the objection that can be raised is of political significance only. The fulfillment of the undertaking would supply abundant water for the exigencies of the Nile and the Soudan, and would render the navigation of the Blue Nile possible in the summer months.

INVENTING GAMES AND FORMS OF ENTERTAINMENT.

One of the most fruitful sources of securing a good income is in inventing games and forms of entertainment for private parties, sociables, and receptions. The extraordinary demand for something new in the line of entertaining is evidenced by the number of new games and tricks put on the market every year. These multiply rapidly, but most of them, being merely variations of old games, attract little more than passing notice. But when a really new and original game, trick, or form of entertainment is invented, the public shows its appreciation by adopting it immediately as the prevailing fad. There are so very few original inventions of this nature that it is safe to say that anyone who has the genius to discover one will reap financial reward sufficient to support her for the rest of her life.

These new forms of amusement need not necessarily be elaborate and expensive in character. Sometimes the very simple ones attract the most attention and actually earn more money for their owners. Women in particular are finding this field an attractive one for testing their inventive abilities. Many who go into it find in a little while that they are unfitted for it. They have great adaptive powers, but not inventive faculties. The former will hardly win renown and financial returns in proportion to the amount of work put in the efforts.

The Patent Office at Washington is besieged by applicants for inventions that are made for the purpose of amusing and entertaining, and the list that is annually rejected because they infringe upon the rights of others is very great. Nevertheless, women have been very successful in the last two years in this direction, and according to statistics given they have equaled the men both in the number and popularity of their inventions to amuse. Last year fully a score of such patents were taken out by women who must have made comfortable incomes from the sales of the articles. One successful trick, game, or puzzle should in the ordinary course of events make a tidy income for a woman for several years.

It is somewhat surprising that women inventors have not invaded this field more numerously than they have, for by virtue of their associations, life-work, and aspirations they should be in closer touch with what children and societies need of entertainment than men. Until quite recently most of the toys and games were invented entirely by men, while women inventors seemed to turn their attention to other subjects. This now has been changed somewhat, and the toys that are annually brought out are the work of minds and hands of women as much as of those of the masculine sex.

The toy season is not by any means confined to Christmas. It is pretty well distributed over the whole year; but the toys differ according to the seasons, and the inventor who wishes to make money with her designs must anticipate events. Birthdays are happening every day in the year, and thousands of toys suitable for such occasions are bought continuously the year round. The popular birthday present is a feature of the toy trade that was never better appreciated than to-day. Heretofore the remnants of Christmas toys were supposed to answer the purpose, and disgusted parents would travel from store to store in a vain search for something unlike the toys that had piled up around the family hearth at the last midwinter holiday. Birthday toys are consequently in great demand.

Who can produce something appropriate for such occasions, suitable to man, woman, boy, and girl? The person who can accomplish this is sure to find a steady sale that will in the end more than aggregate the total Christmas sales. Souvenirs and table decorations of a novel form and shape are also as constantly in demand as the birthday presents, and, like the latter, they must be peculiarly adapted to the purpose. To invent such a gift or souvenir to sell well the mind must study out the question as carefully as if a mathematical problem was offered for solution. One must make herself more or less thoroughly familiar with all the material on hand, and with the inventions in the same field that have been made before. Without this necessary preliminary preparation the chances of successful invention will hardly be very great.

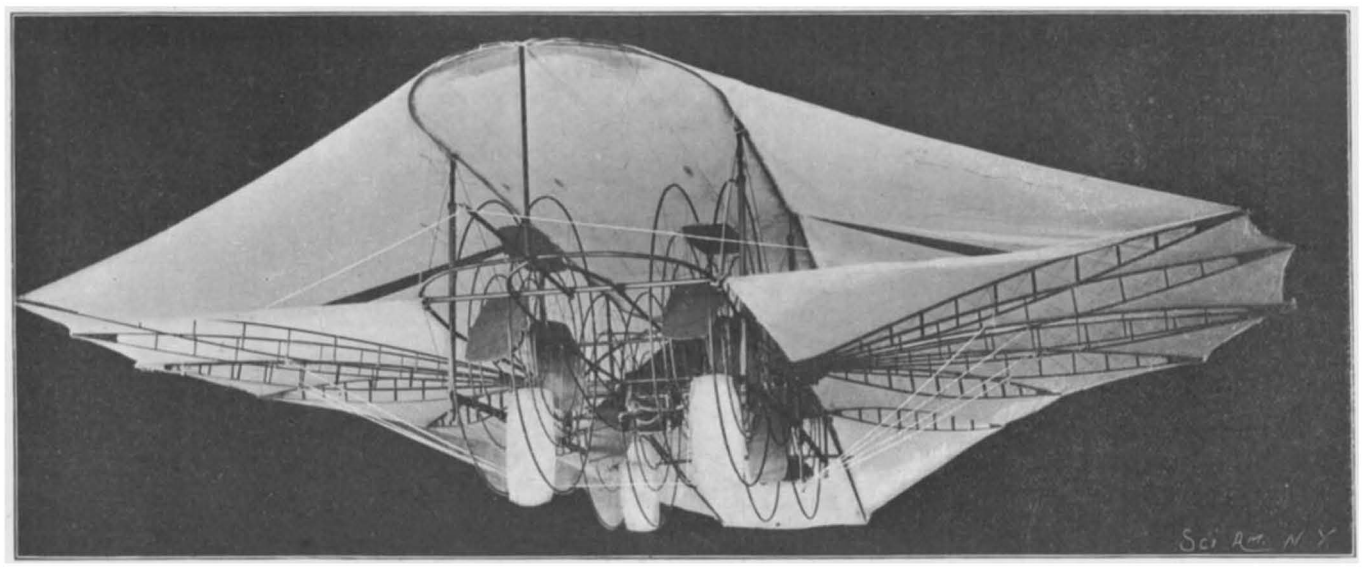
Social games and entertainments for young and old depend largely upon the character of the audiences for their success, and a study of human nature should be one of the first essentials for preparation in this line. A professional entertainer who goes abroad every summer to visit foreign lands to study the little methods of life and social intercourse in Europe always returns with a great fund of new ideas which she modifies and adapts to her American audiences. She is not so original as adaptive, nor so adaptive as tactful. She knows instinctively and by study what her audiences would like, and this she aims to give them. She invariably proves such a success that her entertainments are often repeated by request, and she makes a good income, and secures all the pleasures and advantages of travel abroad. She makes up her programme for the winter ahead of time, and always keeps a certain stock of ideas and plans ahead which she can use in an emergency. Sometimes the best made programme will prove a failure, and it is then that the resourcefulness of the entertainer shows itself. If unable to fall back on something else to make up for the failure she would soon lose prestige.

The professional evening entertainer is becoming more and more a social factor in our large towns and cities, and the demands for her services grow in proportion to the success of the efforts put forth. There are many young women to-day who are making their living in this way, using song, oratory, music, and mind to accomplish their purpose.

Prof. G. J. Peirce points out that the object of respiration in plants is not as in warm-blooded animals, the maintenance of a certain body temperature, together with the production of energy needed for doing work, but, as in cold-blooded animals, simply the latter purpose, says The American Naturalist. The diastase formed in the germinating seed dissolving the starch deposited in the seed as a reserve food-material and converting it into sugar makes the reserve food available for at least three purposes, viz.: (1) For the construction of nitrogenous compounds (amides and proteids); (2) for the formation of cellulose; (3) for the liberation of energy by respiration, nutrition, and growth. The enzymes formed by the lower plants are also useful in more ways than one; not the least important use being the conversion of non-respirable into respirable substances. The sulphur bacteria (*Beggiatoa*, *Chromatium*, etc.) obtain most if not all, of their kinetic energy by oxidizing sulphur compounds.

THE EZEKIEL AIRSHIP.

We have been favored by the Rev. B. Cannon of Pittsburg, Texas, a mechanical expert and the inventor of the Ezekiel airship, with a photograph and description of this latest accession to the flying machines of the world. Mr. Cannon is of the opinion that the Almighty was graciously pleased to show many novelties to Ezekiel, and in support of his contention he cites various passages of Scripture from the Book of Ezekiel, as, for example: "Then the spirit took me up and I heard behind me the voice of a great rushing, saying: 'Blessed be the glory of the Lord from his place.' I heard also the noise of the wings of the living creatures that touched one another and the noise of the wheels over against them and the noise of a great rushing." (Ezekiel iii., 12 and 13.) Other passages in the same book refer to various voyages made by the prophet, according to Mr. Cannon, in a flying machine. He considers that an airship is described in simple metaphors.



THE PROPHET EZEKIEL AIRSHIP.

Mr. Cannon has endeavored to construct an airship according to Ezekiel's specifications. The inventor does not believe in perpetual motion, but thinks there must be cause for effect in everything, as well as a purpose in every word of the Scriptures. He also tells us there are several things described by the prophet which he does not use in the model airship which he is constructing, and very wisely, for the reason that he proposes to protect these ideas by means of patents. The inventor states that the full-sized machine is supposed to be driven by a four-cylinder 8 x 8 gas engine. The gas or compressed air is stored in the frames of the airship. The motor is connected with the ends of the main shafts direct and the speed is 400 to 1,200 revolutions per minute. As will be seen by the engraving, there are a number of wheels built according to the Ezekiel designs. When at rest the device rests upon legs, which may be raised or lowered telescopically within the outer tubing. When the vessel is to be operated, compressed air is forced into the frames of the airship. The wings are then drawn together at the side to stretch them. The extensible legs are drawn up so that the wheels rest on the ground. The air throttle is then opened and air pressure starts the motors. When the machine is first set in motion it runs along the ground upon the wheels and does not begin to rise until the propellers are rotated at considerable speed. Air pumps are then started to keep the cylinders cool. The vessel ascends on the principle of the aeroplane. In descending the internal wheels are turned back far enough to reverse the action of the blades in the wheels. The airship will then come down slowly like a parachute, and just before the ground is reached compressed air is turned into the tube in which slide the brass legs, so that when the vessel alights it has a compressed air cushion to rest upon. The inventor states that Ezekiel's plans are the first he ever worked at in which he could suggest no improvement. A company has been incorporated, with officers and full board of directors, to work out the combined ideas of Mr. Cannon and Ezekiel. The name of the company is the Ezekiel Airship Manufacturing Company, Incorporated. We wish Mr. Cannon every success in his enterprise and trust that he will succeed in rehabilitating other inventions based upon the writings of the prophet.

GREAT SLUICE GATES FOR THE NILE IRRIGATION WORKS.

In an article published in the Scientific American of May 4, 1901, describing the irrigation works at present nearing completion on the River Nile, we mentioned that a special description of sluice was to be employed. Through the courtesy of Messrs. Ransomes and Napier, engineers of London, who are carrying out this portion of the contract, we are able to publish two photographs of this device.

These sluices, which were invented by the late Mr. W. F. Stoney, are of the balanced type. They are so truly balanced that notwithstanding the enormous pressure of water that may be exerted against the gate, it can be raised or depressed with the greatest facility.

Our illustrations show respectively the frame and the sluice gate. They are the largest that have ever been constructed. There are in all 180 sluices to the dam. Sixty-five of these are placed with their sills at 87.50 meters, river-level. That is to say, there will be 87.50 meters depth of water stored behind the dam. Twenty-five will have their sills at 92 meters river-level, fifty (without rollers) at 92 meters river-level—these are only to be operated at certain periods when there is very little head of water pressing against them—eighteen with their sills at 96 meters river-level; and twenty-two with the sills at 100 meters river-level.

All the sluices have openings 2 meters wide by 7 meters high, with the exception of those at 96 and 100 meters river-level, which are only 3½ meters high. The pressure against the lowest sluice is nearly 300 tons, which is all taken through live rollers, moving on planed roller paths, that is to say, one on the gate, and one on the fixed work on each side of the sluice. The sluices themselves are built of steel plates, supported by rolled-steel joists, which in turn are bolted to the cast-iron roller-path beams.

The gates are suspended by steel wire ropes. In the case of the sluices at 87.50 meters river-level the two ends of the rope are wound upon a crab barrel placed at the side of the roadway which reaches across the top of the dam. The crab gear is such that one man can operate each sluice with the full head of water against it, the sluice not being counterbalanced in any way. Cast-iron grooves are built into the dam in order to provide the necessary space for the sluices to work in. These are cast in sections and bolted together in place. A cast-iron sill-piece and a similar lintel form the top and bottom of the sluice opening respectively. An arched roof-casting supports the masonry over the entrance to the culvert in the front of the sluice.

Owing to the cutting nature of the silt in the Nile water, it has been deemed advisable to provide stanching rods on each side of the sluice, and also in the lintel casting. These rods will render the sluice practically watertight, when shut down.

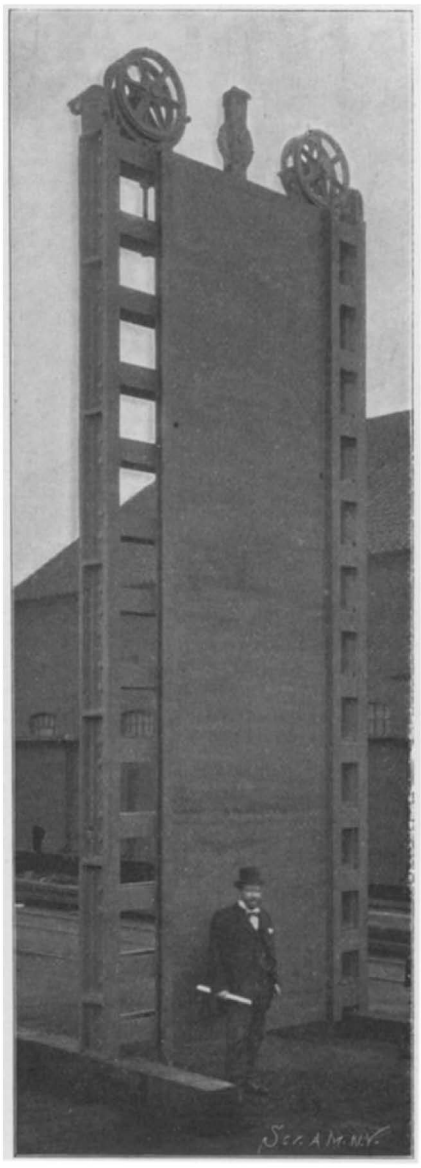
In the case of the fifty sluices at 92 meters river-level without the rollers, the sluice gate slides against the planed faces of the groove castings, and is made watertight against the faces of the groove castings and also on the sill when the sluice is completely lowered. The top is rendered watertight by an adjustable bar, bolted onto the sluice, which lowers onto a projection from the lintel, when the gate is in its final position.

When all the sluices are open the water at high Nile will pass through them with but little obstruction, and when the water is sufficiently clear the sluices will be gradually let down and the reservoir slowly filled. When it is full to the level of 106 meters river-level, the necessary flow will take place through the sluices at 96 and 100 meters river-level. As the reservoir is emptied the lower sluices at 92 meters river-level, with rollers, and those at 87.50 meters river-level, will also be opened to allow the necessary discharge.

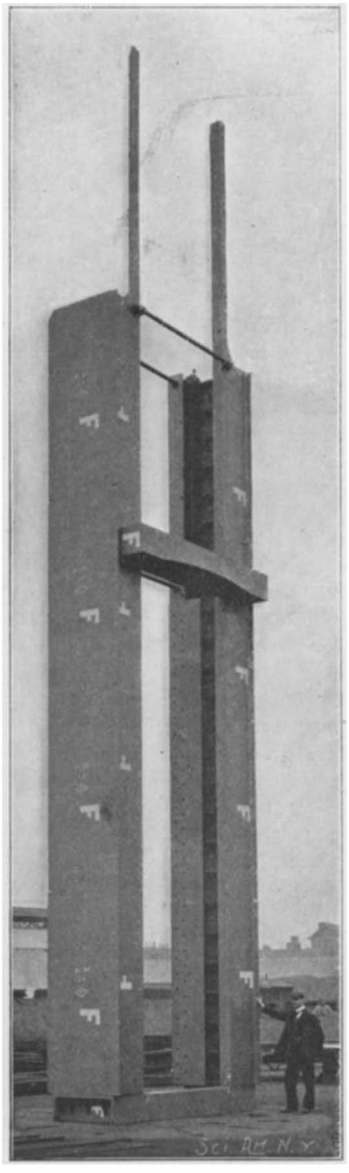
There are five lock-gates in connection with the scheme, all of which are the full width of the lock—9½ meters. The height of each of these gates is 8 meters, 11 meters, 14 meters, and 18 meters respectively, the two upper gates being 18 meters high.

Each gate is hung from a carriage and is arranged to roll back on live rollers into a recess in the masonry, and the live rollers are supported upon bascule girders, which are counterweighted and arranged to lift up, when the gate is rolled back into the recess, so as to offer no impediment to the masts of the vessels passing through. Each gate has twelve sluice openings in it near the bottom, and also four vertical openings actually at the bottom, in order to produce a scour along the lock to remove the silt deposit.

All the operations in connection with the working of the gates and valves are controlled by hydraulic power. A small turbine arranged in the dam will drive hydraulic pumps to serve the hydraulic system for the lock gates.



ONE OF THE 180 SLUICE GATES FOR THE NILE DAM.



A FRAME FOR THE NILE SLUICE GATES.

The Russian Ministry of Ways and Communications appointed a special commission to discuss the project brought forward by a syndicate of foreign capitalists for the purpose of installing a system of electrical towage on the Ladoga Canal. The syndicate proposes to erect works which shall not only supply the necessary energy for towing purposes and for lighting the canal, but be capable of supplying manufacturers and St. Petersburg with power.

Lieut. E. P. Bertholf, who was sent to Siberia last winter by the government to secure reindeer for the Alaskan station, arrived at Port Clarence August 28 with 254 of the animals. He secured the reindeer 100 miles north of Irkutsk, the present terminal of the Siberian railway. The last consignment brings up the total of the government reindeer to 3,912.

AN AUTOMOBILE FORAGE WAGON.

We illustrate herewith, from Les Sports Modernes, a type of forage wagon manufactured by MM. Panhard and Levassor and exhibited in the procession of military equipages at the grand maneuvers of 1900. The wagon, like all the vehicles manufactured by MM. Panhard and Levassor, is actuated by the firm's well-known gasoline motor.

PANHARD-LEVASSOR GASOLINE FORAGE WAGON.

Some Narcotic Plants.*

Narcotics so appeal to the imagination, that sober statements are difficult. Travelers' tales, intending truth, are often exaggerated. Even J. U. Lloyd imagines a fungus that is of the marvelous, and supposes a hidden combination of the elements that alone equals all the narcotics, and fears it will destroy our civilization and even exterminate mankind.

A recent novel uses as a foundation for a long tale, a wonderful dwarf bush of high mountains of Africa, "the dead leaves of which poison the earth, on which no bird builds its nest, no insect constructs a house, no spider spins its web—capable of raising man to a higher, stronger, finer development of brain and muscle than we could conceive of under existing circumstances. A strength-giving herb unapproached in power."

The myths of the Upas tree are so inwrought that it may be news that it is growing in the midst of coffee plantations, birds and lizards on its branches; properly treated, the inner bark can be used for garments.

Omitting the Rhus family, passing the Aminitas that gathers in the mushroom zealots, only mentioning the purple larkspur that kills sheep, in one case 250 died of 500 affected; the "snow on the mountain," a spurge that blisters like red-hot iron, and its kin the Caper spurge, of which a few seeds endanger life; the laurel deadly to sheep and horse and rendering poisonous the flesh of animals that may be themselves immune to the plant; the loco weed so injurious to stock that the State of Colorado paid out in four years $200,000 to check its ravages, so serious is it that a horse may be so locoed as to refuse other food. These are all well known, but a few of the less noted are pareca, hidery-rhay-guill, sleepy grass, darnel and tutu.

On the Amazon River several Indian tribes use snuff, called pareca, which Wood says is made of the seeds of a species of Inga; when a bout of snuff taking is determined on the people become highly intoxicated and then use the snuff.

The effect of pareca is so violent that the taker drops as if shot, and lies insensible for some time; those more accustomed are highly excited; causing them to dance and sing as if mad; the effect soon subsides; other tribes use it to repel ague during the wet season. Lieut. W. J. Herndon, of the United States navy, in 1851 descended the Amazon; he traded for pareca and the apparatus for using it, and saw it in use, and used it. He found it to be a compound of the ashes of a vine, seeds of Acacia angico and leaves of the abuta (cocculus). He says: "The Indian took his pareca; his eyes started from his head, his mouth contracted, his limbs trembled, he was obliged to sit down, or he would have fallen, he was drunk; but this lasted but a few minutes; he was then gayer." He saw it administered to two children overcome with heat and work; in a few minutes they were at play. When lost in the woods, nearly dead from exhaustion and hunger and fever, unable to go farther, Lieut. Herndon took the pareca snuff. "I instantly fell drunk on the hammock, but with a peculiar intoxication, which acted on my limbs like an electric shock; on rising I put my foot to the ground, and to my surprise felt no pain. At first I thought I dreamed; I even walked without being convinced." He then beat the two Indian guides, and walked the two remaining hours of daylight.

Hidery-guill-rhay, or Indian tobacco, not plantain or lobelia, is a plant used by Indians of British Columbia and Southern Alaska, discontinued by mainland Indians, but used until 1877 or 1879 by the Hidas of Queen Charlotte Islands.

The plant dried over fire was pounded with lime into cakes, chewed or pouched in the cheek; the effect was akin to tobacco or opium. Tradition is that the Indians brought the seed with them from a climate in which it grew to a tall tree, planted the seed in Alaska, but the climate reduced it to a shrub. Another myth is that the Deity caused it to grow to a tall tree, and Indian with bow and arrow shot down some seed, which he secreted and from which the tribe obtained the plant. The plant produces a nut or ball full of seeds, like a poppy. I have not been able to get for this plant a botanical name or description. Was it a poppy or betel nut? The use and growth of the plant has ceased, supplanted by tobacco.

Sleepy grass is a Stipa. There are one hundred species; S. inebrians, S. siberica are poisonous and are found in New Mexico, Texas and Siberia. Sleepy grass has a most injurious effect on horses and sheep. It is a strong narcotic or sedative, causing profound sleep or stupor lasting twenty-four to forty-eight hours. The horse after eating it is a pitiable object, head and tail drooping, quivering, sweat pouring down his sides, panting and palpitating. The grass acts as a powerful narcotic, diuretic, sudorific and irritant of the respiratory and cardiac organs. It is distinct from the loco weed.

Darnel, Lolium temulentum, indigenous to the old world, introduced into the United States, apt to grow among wheat and grain, is narcotic, produces vertigo, dizziness, headache and a species of drunkenness; often eaten in bread. Beer in which darnel is an ingredient is drank with impunity. A fatal case is cited of a peasant, who had for several days lived on bread, two-thirds of which was darnel. It acts thus on man, dogs, sheep and horses. Hogs, cows, ducks and poultry are fattened on it. It contains a volatile alkaloid and a solid base which decomposes to temultenic acid. The poisonous property is in the base and acid.

Tutu or toot plant, Coriara rustifolia, of New Zealand, is also called wine berry shrub as wine is made from the berries; the seeds are poisonous. It is a shrubby herbaceous plant, five feet high; horses, goats and pigs are immune, cattle and sheep may be poisoned by it. To cattle fresh from other pasture, or exhausted, the plant is nearly always fatal, first stupefying, then causing strong excitement, death following in a few hours. Sheep and cattle are fattened on it, yet when driven may die. Sheep badly tutued become hermits, and stupid, but no worse as mutton.

The Coriara myrtifolia or tanners' sumac of Southern France killed a child that had eaten leaves and berries. The plant yields a white crystalline glucoside; three grains killed a dog. The Sioux Indians when participating in the sun dance chew a bulbous root growing in that vicinity, which alleviates hunger, thirst and pain, and enables them to endure protracted, violent muscular exertion.

The Ponce Indians make a decoction of a red bean found in the United States from Nebraska to the Rocky Mountains and which produces intoxication.

Hippomane (horsemania), manchineel, manchineal, manzanillo (little apple), is a tree indigenous to the West Indies, Central and South America and Florida, forty to fifty feet high, oval-pointed, toothed, shining leaves three to four inches long, is a Euphorbiacea. A circular was issued to United States soldiers in Cuba, "Beware of the Manchineal tree." The milky juice of the leaf stem irritates seriously any mucous membrane; many strong stories are told of its poisonous effects; it does produce temporary blindness, and it is in general as severe as poison ivy.

The fruit of the Umganu tree, South Africa, yields a strong intoxicating drink for the natives. Elephants are fond of it, becoming quite tipsy, staggering about, playing antics, screaming so as to be heard for miles and have tremendous fights; when in this state the natives leave them alone.

Herodotus says: "Scythians inhaled a smoke that intoxicates, and they rose up to dance and sing."

Plutarch reports a plant of Thrace, the smoke of which when inhaled intoxicates.

* Read at the recent meeting of the Missouri Pharmaceutical Association. Extract from the Proceedings.—The Pharmaceutical Era.

QUEEN ALEXANDRA'S DAIRY.

The agricultural arrangements at Sandringham, the home for so many years of the Prince of Wales, now King Edward VII., are excellent, the dairy being very notable. One thing which is apparent is the absence of modern dairy machinery and apparatus, not even a separator being used. The butter consumed at the royal table owes its fine quality entirely to the exercise of skill and care. As will be seen by reference to the engraving, the use of marble, tile and glass throughout insures the greatest possible cleanliness. The cows are not selected on account of pedigree, but they are fine Jerseys and good milkers, and an accurate daily record of their yield is kept. For our engraving we are indebted to Country Life Illustrated.

QUEEN ALEXANDRA'S DAIRY AT SANDRINGHAM, ENGLAND.

About midnight on Wednesday, July 17, while the Controlling Engineer for Railways at Assam and the manager of the Gauhati-Nazir section of the Assam Bengal Railway were on their half-yearly tour of inspection on the line, traveling through the great Nambar Forest, the special train ran into a herd of wild elephants which were making a night march, as is their custom, along the railway. The engine collided with one of them; and the front wheels were derailed, bringing the train to so sudden a stop that one of the inspection party was thrown out of his berth. Fortunately, the train was going at a slow speed. No damage was done. The engine was rerailed in about an hour, and was able to resume its journey, none the worse for

the encounter. The unfortunate elephant, however, had one of its back legs broken, and was so severely injured internally that it could only lie in the side drain of the slight cutting in which the train overtook the herd. On the train returning the next morning, it was lying dead in the same place. The driver stated that he counted eight elephants in all, and that a young one as well was knocked down, but apparently it was not much hurt, and with the others made off through the forest with loud trumpetings. This is not the first occasion on which a train has encountered wild elephants in Nambar Forest at night.

JUPITER STEEL.

We present a series of illustrations of a plant which possesses especial interest from the fact that it is devoted to a new process of steel-making which promises to exert something of a revolutionary effect in certain branches of the steel industry. Jupiter steel, as the product is called, is an exceptionally high grade of cast steel which is made from wrought-steel scrap, with a liberal mixture of certain other metals during the process of melting. The manufacture is carried on under several patents granted to Andres G. Lundin, and the composition of the steel, the methods of manipulation in the furnace, the special materials and careful work in the molding, have resulted for the first time in the history of the art in the production of a cast steel which, in tests carried out at the navy yard at Boston, has proved to possess qualities of strength and ductility equal to those of forged steel. These excellent results are obtained, moreover, with but little sacrifice of the high economy which distinguishes ordinary cast steel. Perhaps the best evidence of its remarkable qualities is found in the fact that cold-chisels and hatchets, cast to the finished shape in this steel, will, after being put on the emery-wheel, perform their work and hold their edge with perfect satisfaction; and one of the most striking evidences of what might be called the wrought-steel qualities of this cast-steel product is the fact that at the request of the writer two of these cast chisels were placed end to end and welded with perfectly satisfactory results.

The Lundin patents have been acquired by the United States Steel Company, whose plant—which forms the subject of our front-page illustration—is located on the Malden River, West Everett, Mass. The stock yard, which extends for several hundred feet on either side of a spur track from the Boston & Maine Railroad, is the first object of interest at these works. The stock consists of a large variety of mild-steel scrap, among which may be seen boiler-plate clippings, borings from the gunshops, the scrap from sheet-steel works, old crankshafts, and, indeed, any kind of steel that possesses the necessary composition to make up the furnace charge. The melting is carried on in a large furnace house, the steel for the smaller castings being melted down in crucibles and the metal for the larger castings being melted in 25-ton Siemens open-hearth furnaces. The preparation of the furnace charge and the introduction of various ingredients during the furnace treatment is carried out in the manner and proportions indicated by the following example, which will serve to show the proportions, but not, of course, the actual amounts which are treated at one time in the furnaces, the latter having, as we have said, a capacity of 25 tons.

A hundred pounds of steel scrap is placed in a crucible in the furnace and melted to a boiling-point of about 4,000 deg. F. When the boiling-point has been reached, from 1½ to 2½ pounds of ferrosilicon, containing 12 per cent silicon, is introduced into the molten metal. As soon as the ferrosilicon has melted, 2 to 8 ounces of ferromanganese, containing 80 per cent manganese, is mixed with 3 pounds or less of aluminium, and this mixture is introduced into the molten metal, where it quickly melts. After the resulting composition is thoroughly melted, it is tapped into ladles, carried to the various flasks and poured into the molds.

Although the excellence of Jupiter steel castings is, of course, mainly dependent upon the composition and the furnace treatment as above described, particular care is taken in the preparation of the molds. The molding sand is composed of a sharp silica sand, crushed rock, fireclay and molasses, which are mixed in the following proportions: Sixteen shovelfuls of hard silica sand, 4 of crushed rock, 1 of fireclay, and 1½ pints of molasses water, the molasses being diluted with water in the proportion of one to one. The molasses is used to give a bonding effect to the sand during the molding, while the fireclay serves the same purpose during the pouring of the hot metal. After the pattern has been drawn from the mold the latter is carefully dressed up and the finished surfaces are treated with a wash consisting of 99½ per cent of pure silica, ground fine and mixed with molasses water. The flasks containing the completed molds are placed in the baking furnaces, and are then ready for the pouring. The two 25-ton furnaces are utilized for the larger castings, and after the heat is ready it is tapped off into ladles which vary in capacity from 10 to 25 tons. These ladles are handled by a pair of overhead, traveling, electric cranes, one of 30 tons, and the other of 20 tons capacity; they travel the full length of the foundry, which at present measures 130 feet in width by 200 feet in length. The building is being extended to a length of 300 feet, and an additional 15-ton crane will be installed. One of our illustrations shows the metal being tapped from the furnace into one of the larger ladles.

When the castings are cooled, they are cleaned by the sand blast, and then all the rough edges are carefully chipped down until the finished casting conforms perfectly to the original pattern furnished by the customer.

In tests recently carried out by the government this steel has shown a tensile strength of 67,300 pounds to the square inch and an elongation of 25 per cent in 8 inches, while in the bending tests a one-inch-square bar of this cast steel was bent cold through an arc of 93.5 deg. without fracture. As a result of these excellent qualities, Jupiter steel is finding a wonderfully wide range of usefulness in the industrial arts. Thus, the shipwork which is being done for the government and private shipbuilding firms includes the rams for the new United States battleships "Rhode Island" and "New Jersey," each of which castings will weigh 43 tons, and the stern frame, keel and sternpost for the same vessels. Other castings include horseshoes for marine engines, engine thrust bearings, knees, and many small parts ordinarily made of forged steel for the interior construction and fittings of ships, engine beds, engine cranks, crossheads, gear wheels, etc. The castings for the battleships "Rhode Island" and "New Jersey" alone will equal in weight over a million pounds.

Niagara River Development.

Steps preparatory to the development of power on the Canadian side at Niagara are progressing with reasonable rapidity. Already a shaft 185 feet deep, 16 feet long and 10 feet wide has been sunk, and now comes the announcement that A. C. Douglass has been awarded the contract for constructing the tunnel that is to serve as a tail-race from the wheel-pit to the lower river. This new tunnel will be about 2,200 feet long and built in the form of a horseshoe, the same as the tunnel on the American side of the river, where the development of the Niagara Falls Power Company has become so notable. The section of the new tunnel, however, will be slightly larger than the tunnel now in use, the section of which is 21 feet high and 18 feet wide approximately. The new tunnel will be lined with brick, and it will discharge into the lower Niagara River a short distance below the Horseshoe Falls. The contract states the tunnel must be completed by January 1, 1903. The cost will be over half a million dollars. Work will progress night and day, and the method of construction will be similar to that employed in the construction of the present tunnel on the American side. Shifts of men will no doubt work toward each other from both ends. The tunnel on the American side is over 7,000 feet long, and it would seem from the shortness of the tunnel required on the Canadian side that it would not cost so much to develop power on that side. Contracts for the construction of the wheel-pit are to be awarded. The minimum capacity of this wheel-pit will be 100,000 horse power. The first section of the wheel-pit to be built will be about 250 feet long and 200 feet deep, having a capacity of 50,000 horse power. The electrical and hydraulic installation first to be installed will have an output capacity of 25,000 horse power. A supplemental agreement made between the commissioners of Victoria Park, in which the station is to be located, calls for the expenditure of $1,500,000 within two years, but the Canadian Niagara Power Company is prepared to expend this sum quicker if it is possible in the development of the proposed power.

The officers of the Canadian Niagara Power Company are: President, William H. Beatty; vice-president and treasurer, William B. Rankine; secretary, A. Monro Grier; assistant secretary-treasurer, W. Paxton Little. Executive committee: William B. Rankine, William H. Beatty and Wallace Nesbitt.

A New System of Wireless Telegraphy.

A new system of wireless telegraphy has been devised by an English electrical engineer, Mr. Johnson, of London. It possesses several important features which should recommend its adoption, the most salient of which is the complete obviation of tapping the messages in transmission, which at present constitutes one of the principal disadvantages of Marconi's system. The Johnson device is entirely different to that of Marconi, though it can be applied to the latter's apparatus. High masts are entirely dispensed with. At present owing to the patent arrangements not having been quite completed but little information regarding the principle of the invention is given out, but it is understood to be devised somewhat upon the same principle as a stringed musical instrument. The transmitting apparatus comprises chiefly a battery and induction coil, to which is attached a disk which may be adjusted to revolve at any desired speed, which revolves, and which is fitted at the edge with a number of vibrating reeds. The receivers, of which there are two, contain a series of tuning forks capable of being modified to any number of oscillations. The receivers are joined together by means of a wire. The disk of the apparatus is also capable of adjustment to any number of vibrations. The electric waves are transmitted at a certain number of vibrations. The tuning fork arrangement in the receiver is attuned to the same number of vibrations, so that the message during its passage through the air, although it may come into contact with other receivers, unless they are synchronized with the transmitting apparatus, will have no influence upon the waves. The system has been experimented over a distance of three miles with perfect success, but owing to the invention being only in its initial stage it has not been subjected to any severe tests. An experimental station is to be set up at the Earl's Court Exhibition in London and a graphic illustration rendered of its possibilities. The inventor states, however, that he can transmit the messages over the same distances that have been covered by Marconi. The question that arises is what is the range of tuning? Mr. Johnson states that he can produce over 30,000 vibrations per second with a low voltage. The range of combination by this system is so vast that it would be almost impossible to tap the messages. The British Admiralty have submitted the invention to a severe test, and the experts who carried out the examination are stated to be favorably impressed with the invention. It is stated that a trial is to be made with the apparatus by installing the system upon four battleships. It will then be possible to ascertain to what extent the vast amount of steel present upon a battleship, and the extensive range of electric appliances that are used, will interfere with the instruments, so that a conclusive idea of the utility of the invention may be gained.

Automobile News.

A titled automobilist was recently fined a pound for allowing his vehicle to emit steam while passing through the streets of a town.

An attempt has been made to introduce motor wagons on the African caravan route. Sixty were built especially for the work and have been abandoned.

An automobile took fire recently at Springfield, Mass., and the driver, with great presence of mind, ran the burning machine to the nearest fire house and asked the firemen to extinguish the flames. The firemen were quite surprised at having a fire brought to their doors.

One English contemporary, The Motor Car Journal, notes what might have been a serious accident to the motor car which runs between Bishop Auckland and Crook. As it was carrying a load of passengers it was upset by running into an obstruction which had been deliberately laid on the road. Fortunately no one was seriously injured. An examination of the roadway showed that a V-shaped wall had been built across it with stones from a neighboring pit heap, and this at a spot where there was a sloping bend in the road.

The French government has issued a decree settling the question of motor carriage speeds. The carriages are divided into two classes. First, those capable of a speed under 30 kilometers, and, second, those capable of a speed over 30 kilometers per hour. The latter must always carry in the front as well as in the rear, by night and day, a special number. The makers are required to make a declaration of the speed of every machine intended to travel on French roads. Racing on the high roads is forbidden, but in the open country a speed of 18 miles an hour will be allowed. Elsewhere the speed is limited to 12 miles per hour.

The automobile has been put to a novel use upon the Continent. M. Deutsch suggested that at bull fights the picador ride in an automobile, and the scheme was put into operation at Bayonne, September 29, but ended in a fiasco. The automobile was one of 12 horse power, and was all sheathed in with iron to prevent the bull from catching his horns in it. It was intended to have the picador stand on the seat of the car. The bull, however, did not care to come in contact with the strange looking vehicle and devoted his attention to the matador. Finally the bull was induced to make one onset and he struck the front wheel, coming in contact with the iron plate. One of the wheels of the automobile caught one of the hoofs of the bull, laming him. The crowd exclaimed in indignation at the loss of their sport, and the motor carriage had to be removed from the ring and the bull was killed in the ordinary way.

Engineering Notes.

The old wooden boat bridge over the ancient Oxus, on the line of the Transcaspian Railroad, is to be replaced by an iron bridge 5,000 feet long, supported on twenty-four piers. The estimated cost of the structure is $2,600,000.

An industry which should be established in Spain is that of manufacturing gas motors. For use in Spain the motors should be light and simple, so that they could be easily managed by those unaccustomed to the use of machinery.

The first railway systems of the world were inaugurated in the following years, says The Mechanical Engineer: England, September 27, 1825; Austria, September 30, 1828; France, October 2, 1828; America, December 28, 1829; Belgium, May 3, 1835; Germany, December 7, 1835; Russia, April 4, 1838; Italy, September 4, 1839.

An order was recently issued by Admiral Gervais to the crews of the French fleet, congratulating them on the rapidity with which the coaling was accomplished, and on the excellent average attained, says The Trade Journals' Review. Thus the average of the "Gaulois" was 185 tons, and that on the "Saint Louis" 172 tons per hour. On board all the vessels of the fleet, thanks to the enthusiasm of the officers and men, directed by the commanders, the rapidity with which the ships were coaled exceeded all previous results. In conclusion, the Admiral says that in a short time they will have nothing to learn in this respect from the foreigner.

For the prevention of collisions at sea during a fog, Capt. Brinkworth, of Gloucester, England, has designed a novel compass card. The object of his device is that a certain signal should be sounded to denote from what direction the vessel is approaching. He has drawn up a list of signals corresponding to various points of the compass, and when a vessel signals in a certain manner a glance at the card denotes its position and course. The present system of blowing frequent long blasts is extremely unsatisfactory, since it does not signify the course of the approaching vessel. It may be coming end on or broadside. By means of Capt. Brinkworth's compass card each vessel would know the course of the other, and would thus be enabled to avoid a collision.

Prof. Robinson, of the Lafayette Institute of Mechanical Engineering, Lafayette, Ind., read at the last meeting of the American Society of Mechanical Engineers a paper upon some experiments he made with an engine using natural gas as the motive fluid, from which it appears that with a Westinghouse three-cylinder gas engine, having cylinders 13 inches diameter by 14 inches stroke, working single-acting, four-cycle, he obtained a maximum of 142½ horse power, and an average of 113 horse power during a six-hour test; the mechanical efficiency was 79 per cent. The consumption of gas was, per horse power, 10½ cubic feet per hour. The revolutions per minute were about 260; the temperature of the exhaust gases was 1,500 deg., and the ratio of air to gas was 13 : 7.

A drawing of a special stop cock of very simple construction is illustrated in The Iron and Coal Trades' Review. In this stop cock, the plug is reversed, being larger at the bottom than at the top, and it is maintained tightly in its position by a spiral spring let into the large end of the plug. The advantage of this over the ordinary form is that there is no possibility of workmen leaving it loose, as they often do in the common form, and thus cause a great loss of compressed air. Workmen frequently loosen the bottom nut, and knock the plug up slightly in order to loosen it, and then leave it in a leaky condition. That cannot be done in this case. If the plug does not turn easily by the squared end on top, a slight knock on the top is sufficient to loosen it and allow it to turn readily; but it will not be left in a leaky condition, for the spring comes into play and keeps the plug perfectly tight in its seat.

Now that superheated steam is occupying much attention as an economical agent in engines practical difficulties in its action are being discussed. One of the most serious is the friction of the piston in the cylinder, the great heat rapidly dissipating by burning any oleaginous compound that is introduced. A prominent British firm who have used superheated steam for many years, at a temperature of 550 deg., says that the wear in six years of the piston packing was only ⅛ of an inch, the packing being of the Ramsbottom type. Against this testimony, however, a correspondent of a technical journal states that he tried many agents to reduce the wear of the packing, which was very serious indeed (graphite for one, which was blown out of the cylinder quickly) and finally employed a mixture of mica, grease, and graphite, which answered well and was adopted. It seems that superheated steam requires a special piston, which is described as one with cast iron rings of the eccentric type, not snapped in but having bull-rings and a follower, so that the rings may be put in place without distortion.

Electrical Notes.

Electric light is being installed in Buckingham Palace, which is being refitted throughout.

Wireless telegraphy seems to have a great future in the Sahara Desert, as communication can be readily set up between the oases—and there are no wires to steal.

Arrangements are practically completed for running parlor and sleeping cars from Cincinnati to Columbus, Ohio. Sleeping cars for street railways will be a novelty. It is expected that the running time between Columbus and Cincinnati will be about six hours.

The Eastern Telegraph and Cable Company is constructing a third cable from Zante via Patras and the Corinthian Gulf to Syra, the object being to offer a more direct wire communication between Europe and India and Australia. The two old cables will be devoted principally to local needs, the volume of business having greatly delayed rapid communication. There is also under serious consideration the construction of a telephone line between Patras and Athens. The business done between these two places will undoubtedly warrant the undertaking.

American electrical engineers have scored another victory in England. The firm of J. G. White & Company has been awarded a contract to build the corporation tramways of Bournemouth at a cost of £152,000 ($760,000). Especial interest attaches to the proposed lines for the reason that they will be the first ever constructed in Great Britain combining conduit and overhead trolley sections. If the system proves satisfactory it will be adopted by a number of British municipalities. The Bournemouth lines will be constructed by an English company organized by Americans.

Bangkok, Siam, now has an electric light plant and a tramway six miles long, and is laying a second line of equal length. The service is fairly good. The telephone system, however, is decidedly bad. It is owned by the government, and there are some 200 instruments of German make. Bangkok is a city of magnificent distances and as the Siamese are particularly intelligent people they would undoubtedly patronize a good telephone system were it once established. There should be at least 1,000 instruments instead of 200, and this number would, of course, be increased as the system was better understood.

It is distressing to see teams with heavily-laden trucks attempting to ascend the steep inclines of ferry bridges during low tide. At the Pennsylvania Railroad Company's Desbrosses Street ferry a 20 horse power electric gypsey has been installed. When a team is unable to ascend the bridge a rope is attached to the tongue of the truck. A couple of turns are taken around the gypsey and the power is applied by means of a controller. A second one is now being made for the same ferry. Two electric gypseys have also been installed at the Oak Point pier of the N. N., N. H. & Hartford Road. The water there is very deep and the current strong, and they will aid in pulling the boats up to the wharf.

A comparison of the mileage of telegraph line and wire in operation in the United States and Europe is interesting, says The Western Electrician. The Western Union Telegraph Company has 192,705 miles of line and 933,153 miles of wire; the Postal Telegraph-Cable Company has 29,882 miles of line and 184,933 miles of wire in the United States. This makes a total of 222,587 miles of line and 1,118,086 miles of wire. According to the latest statistics of the international bureau of Berne, Switzerland, there is in all Europe 425,600 miles of line and 1,585,267 miles of wire. The United States, therefore, possesses over one-half as much line as all Europe, and over two-thirds as much wire. In comparing the mileage of wire to population, America has one mile of wire to every 77 persons; Great Britain and Ireland has one mile to every 130 persons; Belgium, one mile to every 321 persons, and Switzerland has one mile to every 222 persons.

The electrical rolling stock and equipment for the underground Great Northern and City Railway, from Moorgate Street to Finsbury Park, London, is being supplied by the British Thomson-Houston Company. The service is to be a 3-minute one, and each train will consist of seven cars. Profiting by the experience of the Central London Electric Railroad, electrical locomotives will be supplanted by motors carried on the two end and the central cars. The generating plant is to comprise four vertical cross compound condensing engines developing 1,250 indicated horse power as a normal load, and 1,875 indicated horse power maximum when making 100 revolutions per minute. Each engine will be coupled direct to an 800-kilowatt generator, mounted between the cranks, each generator having 14 poles and giving 525 volts at no load, and 575 volts at full load. The third-rail single-unit system is to be utilized, as in the case of the other London electric railways.

Science Notes.

Eight hundred Japanese will be taken to Dawson to work in placer diggings this coming winter. It is believed that the employment of Japanese at low wages will enable the mines to be worked much more economically.

Lombardy, at one time holding in Europe the highest reputation for its productions in silk and linen, has recently presented to the Pope, for his private altar, an altar cloth, Gothic-Venetian in style, which for pattern and texture is pronounced to be a marvelous piece of work, surpassing by far anything previously turned out in Italian art weaving.

The German census, which started December 1, 1900, and has just been finished, gives some interesting facts. There are 442 cities with a population between 10,000 and 100,000 each. In 1816 the German Empire had 24,833,000 inhabitants; in 1855, 36,114,000; and in 1900, 56,345,000. In the year 1816, Prussia had 13,709,000 inhabitants; in 1855, 21,320,000; and in 1900, 34,463,000. The enormous increase in the large cities of Germany is said to be due to the retrograde movement in agriculture, which has driven people from the country.

An Indianapolis dentist has given up the use of forceps for pulling teeth and has adopted the primitive method of the Chinese, using nothing but his thumb and index finger. He considers that the sight of the forceps themselves is responsible for much of the harrowing part of tooth-pulling and that many nervous persons are greatly shocked by the sight of these instruments. The pain is also said to be less. He can take out the most firmly rooted double tooth in a few seconds. He learned this art from a Chinese practitioner.

While large shoe factories in Germany have combined, independent shoemakers are seeking to obtain the advantages of production on a large scale without giving up their individuality. A meeting was recently held in Frankfort to discuss the advisability of establishing a central workshop for the local shoe concerns and a committee was appointed to devise a plan. It proposed to start a factory with the most modern machinery where every member can have his work done. This is said to be the first attempt in Germany at a co-operative factory. The work will be pushed and the provincial government will materially assist the new enterprise.

Prof. D. McAlpine enumerates the species of fungus, twenty-one in all, in which luminosity (often incorrectly termed phosphorescence) has been observed. Of the species eleven belong to the genus *Pleurotus*, and five are peculiar to Australia. The luminosity is not due to the presence of phosphorescent bacteria, but to a process of combustion in the fungus itself, confined to the living tissue. It is altogether dependent on the presence of oxygen, as also on a sufficiently high temperature, but is not affected by moisture. In all probability the light is given off not within the organism, but from luminous excreted metabolic products. It is probably useful to the fungus in attracting insects which assist in the dissemination of the spores.—Proceedings Linnean Society of N. S. Wales.

It may not be generally known that M. Santos-Dumont, who came so near to winning the Deutsch prize of $20,000, has himself offered a prize of 4,000 francs, this being a year's interest on the Deutsch principal to which he was entitled. He promptly placed this sum at the disposal of the Aero Club for the foundation of a prize bearing his name, to be awarded to any member of the Aero Club who, before October 31, 1901, will start from the club grounds at St. Cloud, travel around the Eiffel Tower and return to the point of departure, without any limit as to time and without having touched the earth, and solely by such means as he may have on board his airship or balloon. If the prize is not granted during 1901 it remains open until a competitor is successful. The prize cannot be won by its founder, nor by any competitor using a balloon or airship designed by M. Santos-Dumont.

In the case of *Hordeum distichum*, R. Kolkwitz finds the amount of CO_2 given off to depend to a remarkable extent on the moisture of the atmosphere, says The Pharmaceutical Journal. When air-dried the grains contain from 11 to 12 per cent of water, and the amount of CO_2 then given off does not exceed 0.33 to 1.5 mg. per kilogramme per hour. With an increase of moisture in the air, the respiration increases very rapidly in intensity, until, when it has reached 33 per cent, the amount of CO_2 given off has increased to 2,000 mg. per kilogramme per hour. Even when crushed or cut into small pieces, the faculty of respiration is not altogether lost. Dr. A. Jencic determined that when seeds have been air-dried, exposure to a very low temperature (—18 deg. C.) accelerates their power of germinating, as is also the case with potato tubers. This is probably due to the conversion, under the influence of severe cold, of insoluble into soluble carbohydrates.

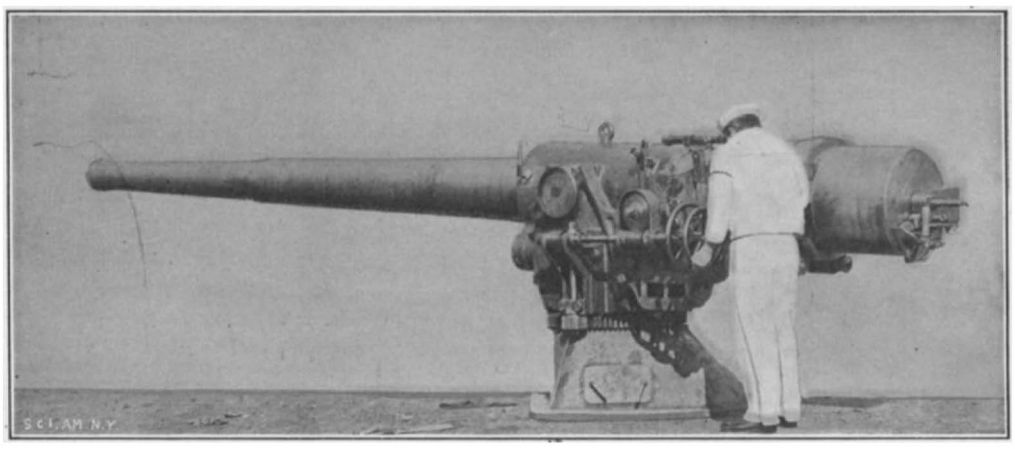
THE NEW 50-CALIBER RAPID-FIRE GUNS OF THE UNITED STATES NAVY.

By the courtesy of Rear-Admiral O'Neil, Chief of the Bureau of Ordnance, we present photographs and particulars of three of the new 50-caliber guns which are being constructed for the United States navy. The weapons here shown have been undergoing tests at the Navy Proving Grounds at Indian Head, and the results as communicated to us are very remarkable, and place the work of the Washington gun factory in the very front rank among the great gunshops of the world. In fact, the Krupp firm is the only one which outranks our navy guns on a single basis of comparison; some of the latest pieces turned out by that firm showing a slightly larger energy of shell per weight of gun than the United States weapons. The Brown wire gun, which was illustrated in a recent issue of the SCIENTIFIC AMERICAN, is expected to show as high, or even higher results than any gun yet constructed; but, as that weapon is at present in the experimental, or rather proving-ground, stage of its development, it can scarcely be classed with the standard accepted types, which are being manufactured, as navy guns are, in large numbers.

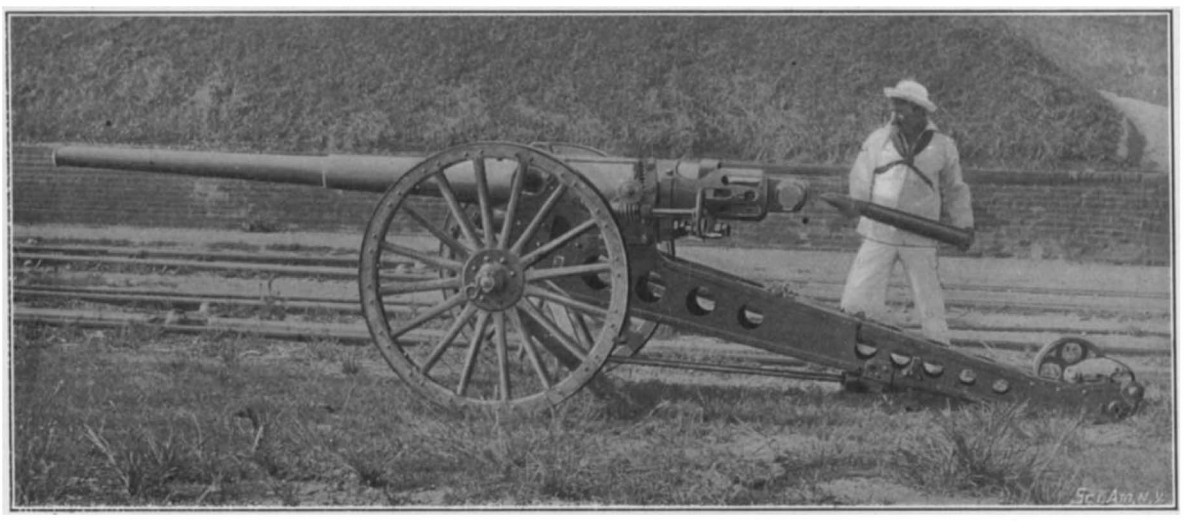
The new 6-inch, 50-caliber gun is shown on the latest type of mount, such as will be used on the battleship "Maine" and her class and on all subsequent vessels of the navy. The weight of the gun is 8.45 tons, and of the mount 5.43 tons. The shield will weigh 2.7 tons, making a total weight for the gun complete of 16.58 tons. The piece was designed for a chamber pressure of 17 tons to the square inch, and with a pressure of 16.7 tons it has imparted a muzzle velocity of 3,023 foot-seconds to its 100-pound projectile.

Another photograph shows the new 50-caliber, 5-inch gun, of which sixty are now being made at the Washington gun factory for the six cruisers of the "Denver" class. The weight of the gun is 3.3 tons, and of the mount 2.5 tons. With a charge of 26 pounds of smokeless powder a muzzle velocity of 2,990 foot-seconds was imparted to a 60-pound projectile, the only on having produced a very effective piece, but also one of exceedingly handsome and well-balanced appearance.

The smallest gun is one of the new 14-pounder, 3-inch, 50-caliber rapid-fire guns, which will form a very important feature in the rapid-fire battery of our new cruisers and battleships. This piece is designed to throw a 14-pound projectile with a muzzle velocity of 3,000 feet per second and a muzzle energy of 874 foot-tons. At the muzzle it is capable of penetrating 13½ inches of wrought iron. All of our later battleships carry—in addition to the 14-pounders mounted in broadside—a pair of 14-pounders mounted on field mounts for use by landing parties. The accompanying illustration shows one of these guns as it will appear when in action.



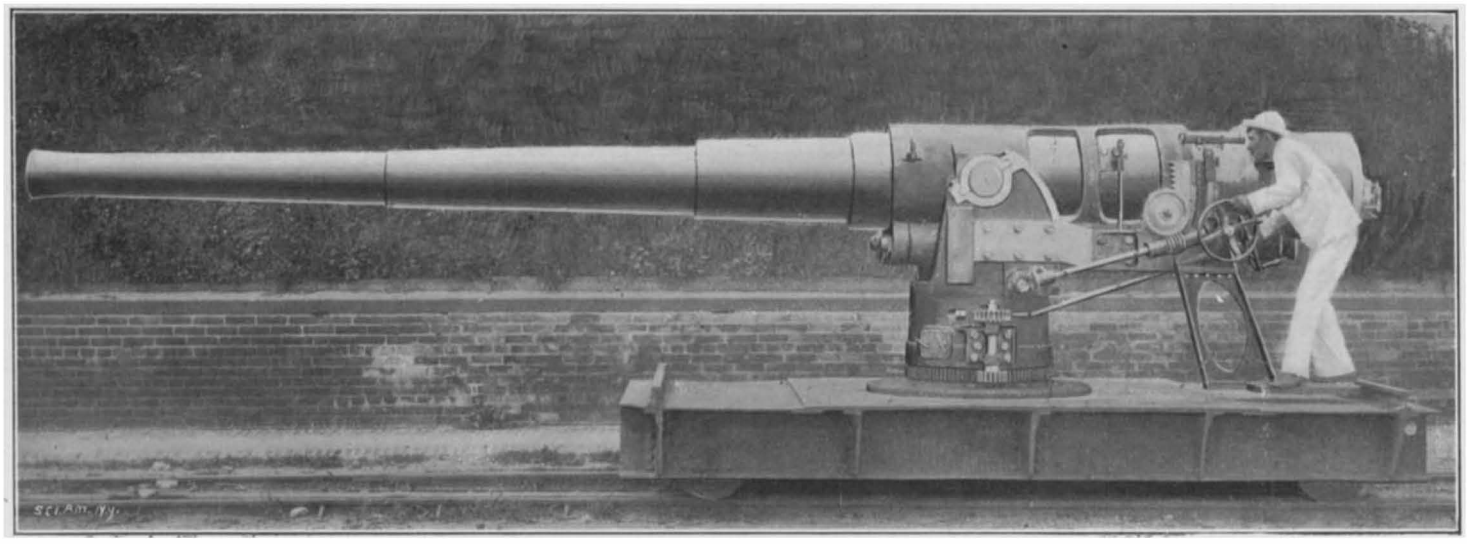
NEW NAVAL 50-CALIBER 5-INCH RAPID-FIRE GUN.



NEW NAVAL 50-CALIBER 14-POUNDER FIELD GUN.

chamber pressure being 16.4 tons, or 0.6 of a ton to the square inch less than the pressure of 17 tons per square inch, for which the gun was designed. With a pressure of 16.75 tons to the square inch in the powder chamber, a muzzle velocity of 3,330 foot-seconds was imparted to a 50-pound projectile.

Both of the above guns are fitted with the very latest improvements to facilitate rapidity of loading and secure accuracy of fire. These features are shown in the photographs of each gun, particularly in that of the 6-inch gun. In the case of the last-named piece the gunner stands on a platform which is bolted to the gun-carriage immediately to the left of the breech, and consequently, as the gun is traversed, the gunner moves with it and is always in the same relative position to the piece. Conveniently for manipulation are placed two hand-wheels, one operating the elevating gear and the other the traversing gear. In front of the gunner's eye is seen the telescopic sight—an important feature in all modern ordnance. The gun itself recoils in a sleeve in which are formed the trunnions and at the bottom of which, and cast in one piece with it, are the hydraulic recoil cylinders, the pistons of which are connected by piston rods to the breech of the gun. The guns are fitted with an improved and greatly simplified pattern of breech-block, which is unlocked and opened by a single swing of a lever. The Ordnance Department is to be congratulated not



NEW NAVAL 50-CALIBER 6-INCH RAPID-FIRE GUN.

Electroplated Doors.

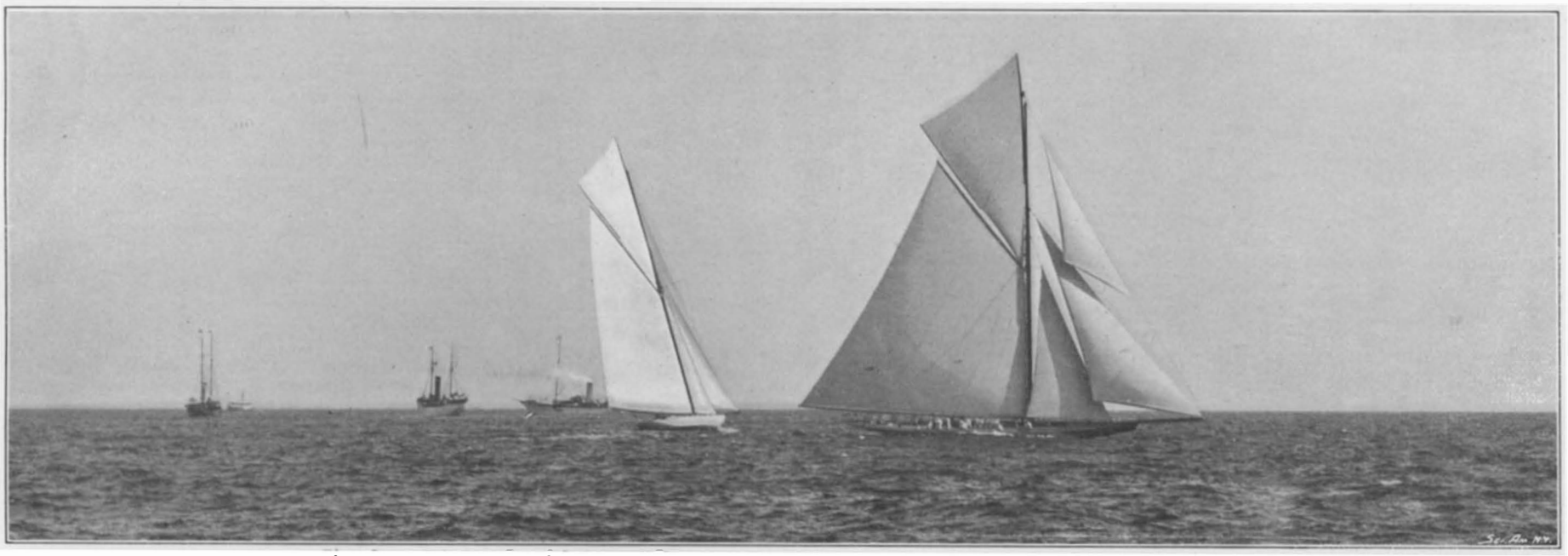
An inventor of Bridgeport, Conn., has just devised a process of electroplating wooden doors with copper, brass and other metals so as to produce a door which is thoroughly inclosed in metal without any visible seams so as to give the appearance of a solid metal door, but which will be cheaper, lighter and generally more desirable than if made of solid metal or covered with sheets, as is now sometimes done. Doors of this class can be extensively used as entrance doors to flats or other large and expensive buildings where massive and elaborate effects are sought. Such doors are considered a valuable adjunct in preventing the rapid progress of fire, and metal-protected doors are frequently used in theaters. There is no necessity of burning off the varnish in order to revarnish, as is necessary with the old methods of covering or protecting. The finished wooden doors are first filled with a wood filler as, for instance, a mixture of linseed oil and resinous gum, which is designed to waterproof and protect the wood thoroughly and prevent warping. The doors are placed in a tank filled with the heated filler which is kept hot by steam. After the filler has thoroughly penetrated the wood they are hoisted, permitted to drain off and laid upon a table for further applications. The door is then rubbed smooth and coated with a varnish as shellac and is then dried. This operation is continued until the desired surface is obtained. The edges of the door are then trimmed with sheet metal strips corresponding to the width of the door. They are attached to the four edges by means of nails, screws, or cement. The material used for the strips is preferably copper, bronze, or brass. The face of the strip on the edge of the door is covered with a metallic insulating varnish, after which the entire door is coated with a metal substance, such as thin metallic leaf, metallic brass powder, or common varnishing wax with plumbago. When the coatings applied have become dry the door is rinsed and is ready to receive the electric deposit. The door is supported in a vertical position in the plating bath. One wire goes to the anode, and the second wire is preferably attached to the metal strip on one edge of the door; the current is then turned on, and the electrolytic action takes place until the surface is covered to any desired thickness. The advantage obtained by covering the edges of the door with a sheet metal strip is that its high conducting power makes a complete circuit around the door, and the width of the strip insures an even and unbroken surface between the two sides.

THE 1901 CONTEST FOR THE "AMERICA" CUP.

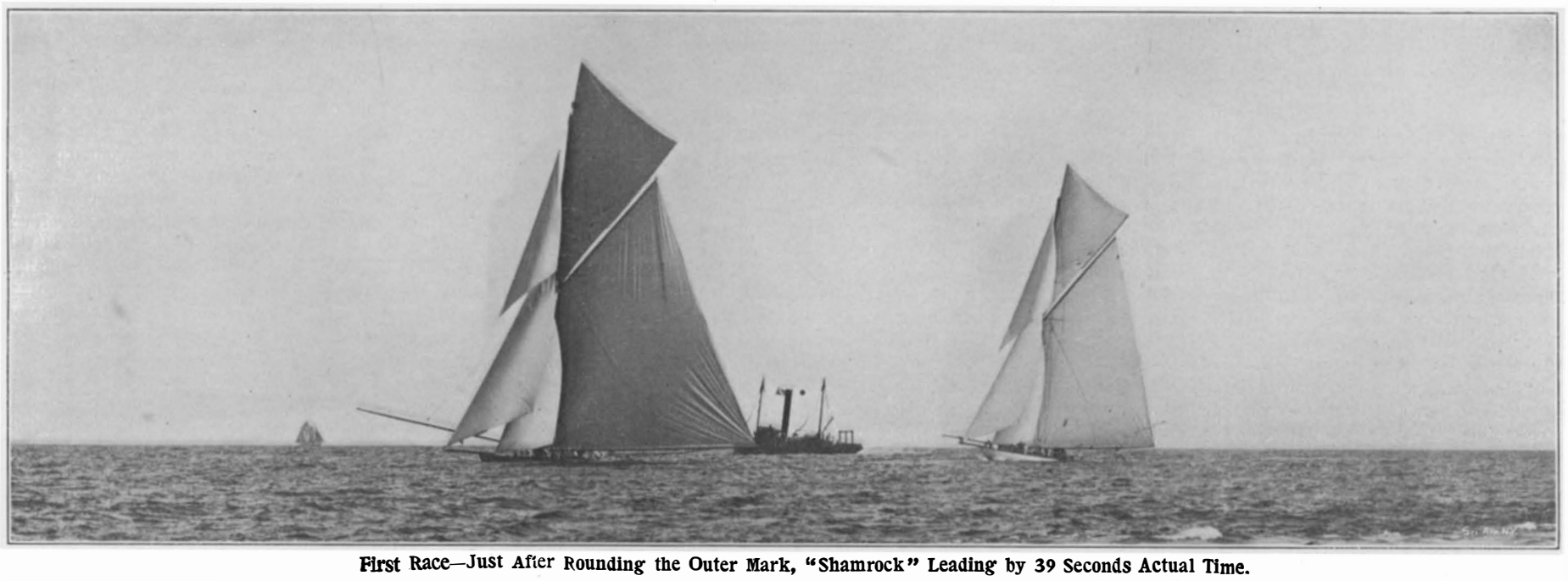
In all the half century during which contests have been waged for the "America" Cup there was never fought out such a close and exciting struggle as took place in the first race of Saturday, September 28, and the last race of October 3. On the former day, from the moment when the yachts crossed the starting-line practically abreast, to the boom of the finishing gun—4½ hours later—when the winner was only three or four lengths in the lead, there never was a time when the yachts were more than a stone's-throw apart, while there was more than one occasion when the proverbial biscuit could have been tossed from one yacht to the other; and in the last race the yachts finished practically abreast.

The conditions were more favorable to the "Shamrock" than on the previous Thursday, when there was not enough wind to finish. The sea was much quieter and the breeze stronger, although the latter was never over eight knots in force, and fell at times as low as four or five knots. After some exceedingly clever maneuvering by the rival skippers, they crossed the line practically abreast, with "Shamrock" in the weather berth and two seconds in the lead. It was confidently expected that on the 15-mile beat to the weather mark "Columbia" would pull out from under the lee of the challenger and widen the gap on every board that was sailed. She had hitherto shown herself to be invincible in beating, and most of her victories over "Constitution" had been made on this point of sailing. To the surprise no less of her people than of the great majority who believed "Columbia" to be invincible on this point of sailing, "Shamrock" appeared to point as high and foot as fast as the

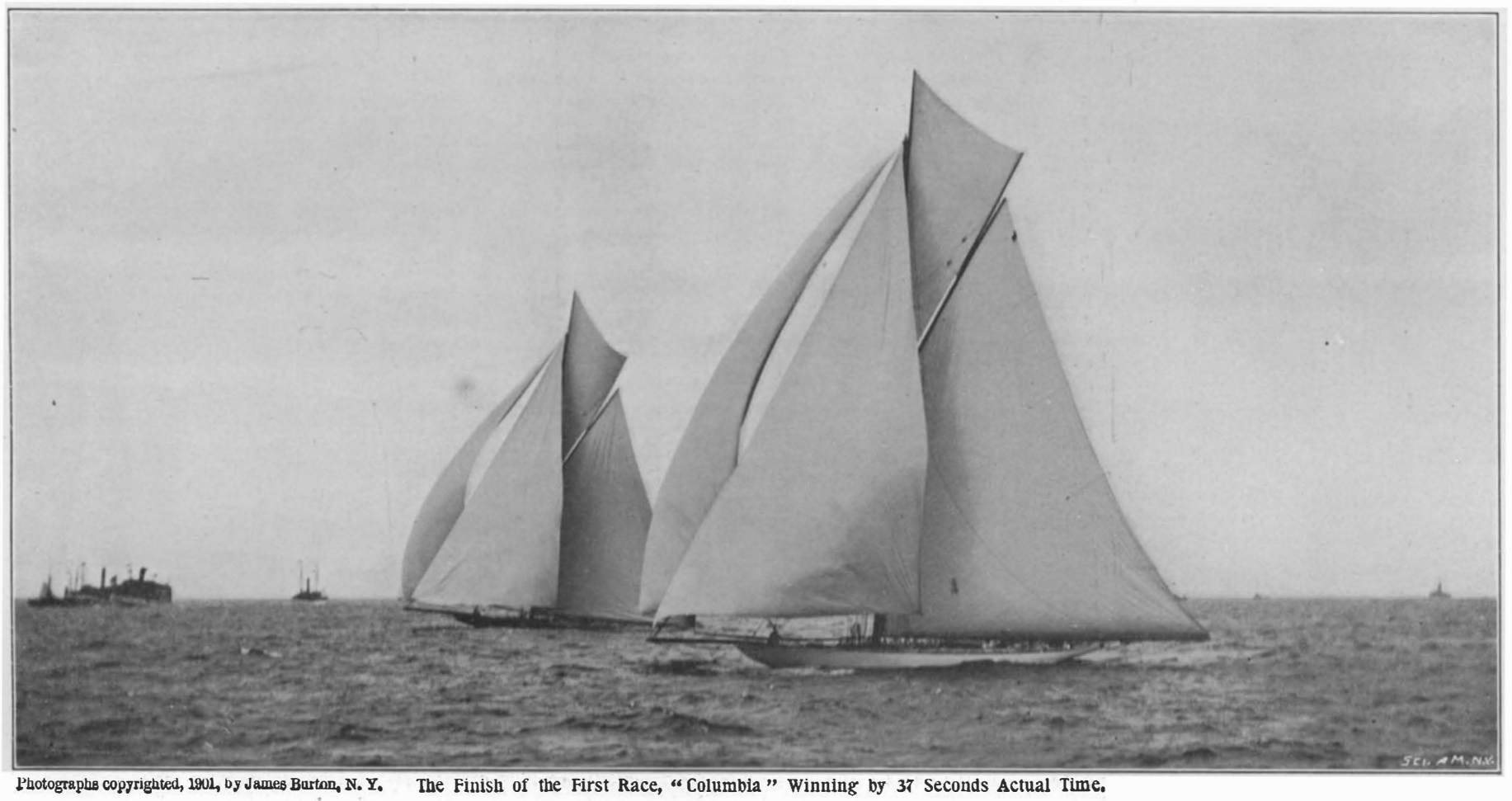
The Triangular Race of Thursday, October 3—Ten Minutes After the First Turn, "Shamrock" Leading.



First Race, Windward and Return—"Shamrock II." Going About on the Port Tack, Just After the Start.



First Race—Just After Rounding the Outer Mark, "Shamrock" Leading by 39 Seconds Actual Time.



Photographs copyrighted, 1901, by James Burton, N. Y.

The Finish of the First Race, "Columbia" Winning by 37 Seconds Actual Time.

THE 1901 SERIES OF "AMERICA" CUP CONTESTS.

American boat, and when, after half an hour's sailing on the starboard tack, "Columbia" put about in the effort to cross the English cutter's bows and failed to do so, it was evident that, in a moderate breeze and fairly smooth sea, "Columbia" had at last met her match in windward work. Three times "Columbia" made an unsuccessful attempt to gain the coveted weather berth. She would be eased off and given a "rap full" in the endeavor to draw far enough ahead to cross her opponent's bows; but the boats were too evenly matched to render this possible. On the last board "Shamrock" was pinched so high into the wind that her captain was able to come down to the mark with started sheets, and most of the gain of 39 seconds was made at this time.

The outer mark was rounded by "Shamrock" at 1 hour 25 minutes 12 seconds, and by "Columbia" at 1 hour 25 minutes 53 seconds, or 41 seconds later. Deducting the two seconds' advantage of "Shamrock" at the start, the actual gain was 39 seconds.

Immediately on rounding the stake, "Shamrock" luffed, in order to escape a blanketing by "Columbia." The American yacht also luffed, and for several minutes both vessels kept up the canvas with which they had gone to windward mark. One of our illustrations was taken at this time, and shows how the rival skippers were waiting on each other to break out the spinnaker for the run down the wind. Five minutes after rounding, this large triangular sail and also the largest jib-topsail were broken out on each yacht, and they were fairly on the home course.

Although the "Shamrock" was 39 seconds to the good in actual time, she had to allow the "Columbia" 43 seconds on the 30-mile course, and therefore she was at this time just 4 seconds to the bad on corrected time. Hence it was necessary for her to gain a few seconds more on the 15-mile run, if she was to win the race. Popularly, it was supposed that, with her extra 800 square feet of sail area, she would easily do so; but, as a matter of fact, the wetted surface of "Shamrock" is considerably greater than that of the American boat—so much so that the extra skin-friction overbalanced the extra driving power of the sails —and slowly the "Columbia" began to gain. Before many miles had been covered, the yachts were abreast and then "Columbia" drew slowly ahead. So close was the race, that "Shamrock" drew up again on even terms within three miles of the finish, and it was only when the finishing gun boomed that it was made certain that the American boat was the first over the line. Thus was won, by a margin of 1 minute and 20 seconds, corrected time, and 37 seconds, actual time, the most closely contested and exciting race in the history of the Cup.

In the second race, sailed on Thursday, October 3, the "Shamrock" was favored with the very conditions of wind and sea and course under which her friends have claimed that she would do her best sailing. The wind was blowing from off shore at an average strength of 15 knots, with occasional puffs in which it rose to fully 20 knots. The sea was smooth, and the course, a triangular one, was laid out so that the first two legs would consist of reaching and the last of a beat back to the starting-point. "Shamrock" crossed the line at the start with a lead of 1 minute 34 seconds; she took 50 minutes 57 seconds to reach the first stake, and turned it 1 minute 12 seconds ahead of "Columbia," the American yacht having gained 22 seconds in the ten miles. The second leg was covered by "Shamrock" in 54 minutes 41 seconds, and she turned the stake with a lead of 48 seconds, having lost 24 seconds on the second leg. She was now 2 minutes 5 seconds to the bad including 43 seconds handicap, and it remained to be seen whether she could gain something more than that amount on the 10-mile beat to bring her home a winner. The issue was not long in doubt. As she turned the stake, the challenger kept on the starboard tack, waiting to see whether the "Columbia" would follow, or elect to make a close turn and put about on the port tack. The move was fatal to her chances of maintaining her weather berth, for "Columbia" put about immediately on rounding; and, although "Shamrock" immediately followed suit, "Columbia" had no difficulty in sailing through her lee into the weather position. It was soon seen that the American yacht pointed higher and footed equally fast, and it now became merely a question by how much she would win. Both boats drew home to the Sandy Hook Lightship on the starboard tack and crossed the line with a smother of foam at their bows and their lee rails awash. "Columbia" crossed at 2 hours 15 minutes 5 seconds, and "Shamrock" at 2 hours 16 minutes 24 seconds, the challenger having lost 2 minutes 5 seconds on the 10-mile beat. Adding the time by which "Shamrock" was ahead at the start and the time allowance, 43 seconds, "Columbia" won the second race by the safe margin of 3 minutes 35 seconds. The race, while not so close as that of the previous Saturday, was more spectacular. The yachts at times, in the heavier puffs, would heel to an angle of 40 degrees, and the water would come boiling over the lee bow and sweep the full length of the deck. It was a magnificent test, in which the better boat won out on its merits.

Close as was the first race of the series, the third race, sailed on Friday, October 4, was even closer and more exciting, the "Shamrock" covering the course in 20 seconds less time than the Columbia, but losing the race on corrected time by 41 seconds. The wind was of about 10 knots' strength at the start falling to about 6 knots at the finish, and the course consisted of a 15-knot run to the outer mark and a beat back.

Although the race of the previous day had satisfied the yachting "sharps" that "Shamrock" could not win under any conditions, the race of Friday was not fifteen minutes old before it was seen that in running before a 10-knot breeze "Columbia" had more than met her match. Both boats crossed the line outside of the handicap time and were therefore timed at 11 hours 2 minutes; but "Columbia" had an actual lead of 18 seconds. "Shamrock" immediately began to overhaul her, and passing her to port drew ahead so fast that after an hour's sailing she had a lead of two minutes or over a quarter of a mile.

Each yacht had the wind perfectly clear, and as "Shamrock" was luffed well clear of "Columbia" it was evident that if the wind held true at the rate she was gaining she would lead at the outer mark by at least four minutes. This would be more than even "Columbia" could hope to cut down in windward work. The wind, however, gradually lightened, and then freshening to over 12 knots it brought up the following boat with a rush, and before "Shamrock" caught the puff her lead had been cut down to less than 15 seconds. Again she began to pull out, and finally she rounded the stakeboat with a lead of 49 seconds. Then began a magnificent struggle to windward in which "Shamrock," to everyone's astonishment, increased her lead for the first 10 miles, when the yachts split tacks and "Columbia" went over to the Jersey shore in search of the stronger puffs. At 2:40, after two hours of tacking, the yachts met on opposite tacks, and "Shamrock" forced "Columbia" about, and at 3 hours 17 minutes they met again with a like result. The remaining quarter of an hour was a most exciting struggle for the finish, the yachts finally crossing the line abreast, with "Shamrock" in the lead by two seconds.

Thus ended the twelfth and most hotly contested series of races ever sailed for the "America" Cup. It finds the "Shamrock" defeated, but carrying the honor of having in each race been the leading yacht at the outer marks. She also may find consolation in the fact that, with the single exception of "Valkyrie II," she is the only challenger that has been able to hold the American boat under her lee in a 15-mile beat to windward. Twice she did this; and she will receive from American yachtsmen all the credit due to a craft that can perform such a feat against a yacht of such splendid windward qualities as "Columbia."

As for "Columbia," she may be safely set down as the most successful all-round Cup yacht that ever hoisted racing canvas—a yacht that is so good that her own designer was unable to build a boat to beat her.

Balloon Trip Across the Alps.

An important balloon trip is that which is shortly to be undertaken by Capt. Spelterini, who proposes to cross the Alps, starting from Saint-Moritz-les-Bains. The envelope of the balloon which is to make the traject has been ordered from August Riedinger, an Augsburg constructor. It will be composed, like the German military balloons, of two layers of canvas separated by a thickness of caoutchouc. The balloon is to have a diameter of 45 feet and a volume of about 1,800 cubic yards, and will be filled with hydrogen. The gas will be brought to the place in steel cylinders containing 170 cubic feet each and weighing 150 pounds. These cylinders have been loaned by Count Zeppelin and filled at the Gmür establishment, at Lucerne, at a pressure of 150 atmospheres. To fill the balloon about 350 of these cylinders will be needed, representing a total weight of 22 tons. It is estimated that it will take about 5 or 6 hours to fill the balloon from these cylinders.

The new system of aerial telegraphy from automobiles, designed by Marconi, is said to have been quite successful during the last military maneuvers in England. Two automobiles are each provided with a mast and contain the necessary instruments for aerial telegraphy, and may thus communicate at a considerable distance. The vehicle used is a steam omnibus of the Thornycroft pattern, weighing 5 tons and giving an average speed of 10 to 15 miles an hour. The mast wires are mounted upon an insulated metal cylinder which is supported on the roof of the vehicle toward the front. The cylinder, which is about 23 feet high, can be folded down when not in use. It is thus possible to telegraph between the automobiles while they are in movement, and this had already been done with success. Messages can be received at a maximum distance of 20 miles, but Marconi claims that this can be considerably increased.

Experiments with Phosphorescent Bacilli.

M. T. Tarchanoff has made a number of experiments upon the phosphorescent bacilli of the Baltic Sea, with a view of determining the influence of different conditions upon their luminous activity. The fresh cultures of these bacilli give the strongest light, especially when the bouillon is in movement and becomes mixed with air. The luminous capacity of the bacilli lasts for periods varying between two or three weeks and two or three months, according to the conditions of the containing substance and of the external atmosphere. The emission of light by these bacilli is one of the manifestations of their respiration, and is intimately connected with their consumption of oxygen. The light appears to be periodic in character, but without any regularity in its periods. In a state of repose the luminous layer is concentrated in the upper layers of the bouillon. This is accounted for by the proximity of these layers to the air, and also by the active movements of the bacilli, which direct them toward the oxygen. A series of movements or shocks given to the bouillon illuminates its whole mass, on account of the introduction of air to the interior, as well as the fact that the shocks act as an excitant. The influence of temperature is another point. The bacilli will resist cold much better than heat. The best temperature is found to be from 7 to 8 deg. C. They will, however, still give off light as low as —4 deg. C., and even in part during the complete congelation of the bouillon, which takes place at —6 to —7 deg. The remarkable phenomenon of a "luminous ice" is thus observed. The phosphorescent bacilli in the icy medium thus preserve their vitality not only in the latent, but in the active form, with emission of light. After a few hours the luminosity of the ice becomes extinct, but when the bouillon is remelted it again becomes luminous. The ice under these conditions has been photographed by its own light, by applying it against the sensitive plate, with a separating plate of glass between it and the film. As regards high temperatures, it is found that heating the bouillon weakens the light, and it becomes wholly extinct at 34 to 37 deg. C., coming back upon cooling. When heated as high as 50 deg. the luminous effect is destroyed once for all. Chemical agents have also a marked influence. Anæsthetics, such as chloroform or ether, destroy the light almost instantly, but on the other hand, many of the poisons, such as strychnine or curare, appear to be indifferent. Cyanide of potassium extinguishes the light, as well as chlorhydrate of quinine, which diminishes oxidation in general. A current of carbonic acid gas has the same effect. The acids are more hurtful than the alkalies. Of the animal humors the bile has the greatest effect, owing to the biliary salts which it contains. Blood, lymph, saliva and pancreatic juice are almost indifferent. The gastric juice and the intestinal secretion have marked and contrary effects; the former, owing to its great acidity, quickly destroys the light of the bacilli, while the latter seems to be the only chemical agent which will increase the luminosity. This effect is not due to its alkaline nature, but more probably to its ferment, which M. Pawloff has shown to be extremely energetic. When an electric current is passed through a tube containing the bouillon, the luminosity becomes localized in a few minutes at the negative pole, where it finally disappears. The bacilli seem to be dragged in the direction of the current, in spite of their natural tendency toward the oxygen, which is found at the positive pole. In a tube which has become extinct by the action of the current the bacilli have not lost their vitality, for the introduction of a bubble of air generally brings back the phosphorescence. Mechanical shocks, such as oscillations, given the tube, or strokes up to 50 per second, increase the effect at first, but after some time they weaken or even extinguish it. A bubble of air will restore the light as before. One of the most singular experiments made by M. Torchanoff was that of the "luminous frog." This is obtained by introducing a small quantity of the bouillon into the dorsal lymphatic sac of the frog, when the liquid penetrates into the neighboring lymphatic sacs and into the blood, and gradually illuminates the whole of the animal, especially the transparent parts. The tongue of the frog shines the most brilliantly, owing to its sac, which contains a luminous lymph. A photograph of the frog is obtained by applying it against the plate (with a glass plate between), and the contours of the animal are found to be the best defined in the negative. The phosphorescent bacilli thus find in the humors and organs of the frog an oxygenized medium which is favorable for their existence. Nevertheless, the luminosity becomes extinct after three or four days, as the bacilli are probably destroyed, and the animal comes back to its normal state. It is to be remarked that this experiment will not succeed in the case of warm-blooded animals, as the phosphorescence of the bacilli is extinguished at a temperature of 36 to 38 deg.

Suez Canal Figures.

The figures for the navigation of the Suez Canal show that out of 3,441 vessels which passed through it in 1900, as many as 3,139 are classed in the night passage, partly by the aid of electric light, or 91.2 per cent, and only 302 vessels, or 8.8 per cent, for the day passage. For the last eight years the comparative results of the day and night navigation are given in the following table, the second column representing the number of vessels which passed the canal partly by the aid of electric light, and the third column shows the number passing by day:

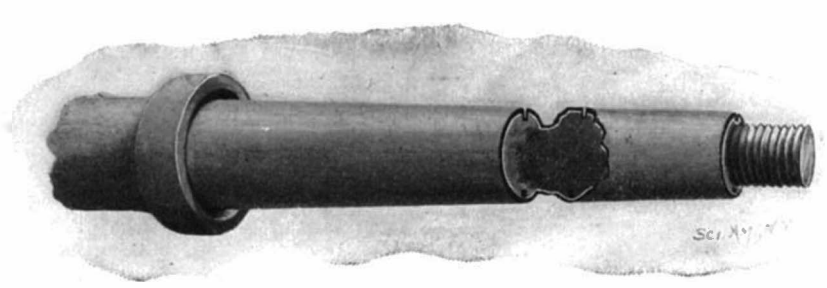
	Night Passage.	Day Passage.	
Year.	Vessels.	Vessels.	Total.
1893	3,082	259	3,341
1894	3,180	172	3,352
1895	3,266	168	3,434
1896	3,211	198	3,409
1897	2,837	149	2,986
1898	3,294	209	3,503
1899	3,273	334	3,607
1900	3,139	302	3,441

A SKEIN FOR WAGON AXLES.

To provide a means for protecting axles from the enormous wear to which they are subjected, Mr. Fritz A. Schulz and Mr. Alfred J. Koetschau, of 212 Humboldt Street, Chicago, Ill., have patented the simple skein illustrated. At diametrically opposite sides of the journal longitudinal grooves are made, which are intended to serve as a means for locking the skein in position.

The skein itself consists merely of a sheet of metal having flanges at its side edges, which sheet is curled, so as to form a split tube. Thus bent, the skein is tempered so that it becomes essentially a spring. The spring tube thus formed is slipped over the journal in such a manner that the flanges previously mentioned will enter one of the longitudinal grooves of the journal. The wheel can now be placed in position; and the wear will be taken up entirely by the skein. The groove in which the flanges of the skein are received serves admirably as a grease-duct. Should the bottom of the skein become worn, as will very likely happen with continued use, the skein is taken off and turned half way around so that the flanges are locked in the other groove. The wear of the wheel will now be borne by the other side of the skein.

This simple device has been subjected to severe tests and has proved itself highly efficient. It has been found that axles which are to be provided with skeins need not be finished, but can be left rough. It has also been found that the skein can be very easily applied to old axles without making any changes in the hubs of the old wheels. If many of the devices at present on the market be used the bore of the hub must be enlarged in order to fit over the skein. The present invention obviates all such difficulties.



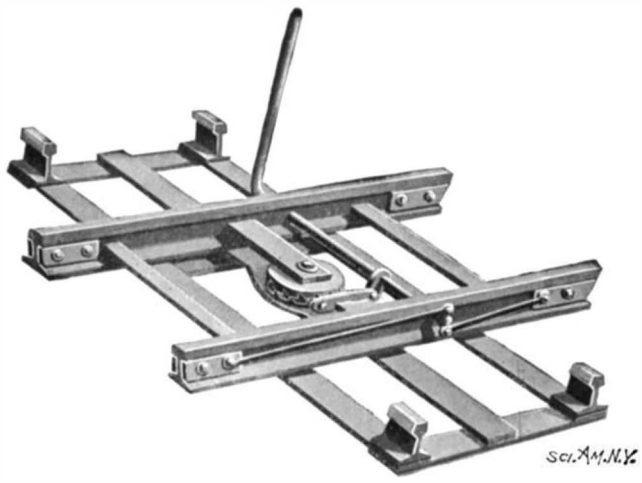
A SKEIN FOR WAGON AXLES.

TURNTABLE FOR HAND-CARS.

The accompanying illustration pictures a novel turntable invented by Thomas Langley, of Corvallis, Oregon, which turntable is intended to shift a railway hand-car from the main track to a side track, or to a track leading into a shed.

Between the adjacent ends of the main track-rails, a base-frame is extended. On the base-frame a turn-plate is mounted, having ratchet-teeth on its upper side. Engaging with the turn-plate is an upper plate having ratchet-teeth on its under side. This upper plate is connected with one of the cross-bars which connect the turntable rails, as our illustration shows. A shaft mounted to turn in the turntable-rail is provided with an arm having connection with the turn-plate, so that a rotation of the shaft will also rotate the turn-plate. At the ends of the turntable-rails, fish-plates are mounted, so secured by bolts passing through slots in the rails that they have a limited sliding movement. Links extend from the bolts to crank-arms on the shaft previously mentioned, the arrangement being such that when the shaft is turned the fish-plates will be drawn inwardly along the turntable-rails. The shaft is operated by an arm.

When the turntable is in closed position its rails will be in alinement with the main track-rails, its fish-plates will extend across the gaps between the turntable and main track-rails, and the arm of the shaft will lie horizontally beside the adjacent turntable-rail. If it be desired to open the turntable for the purpose of shifting a hand-car to a siding, the shaft-arm is swung up, thereby retracting the fish-plates so that the table is free to turn, and rotating the turn-plate so that its ratchet-shaped teeth, by sliding on the inclines of the teeth of the upper plate, will raise the upper plate and elevate the turntable. When the parts are in this position the turntable with the hand-car thereon can be easily moved to open parts.



THE LANGLEY TURNTABLE.

Labor Conditions in Germany.

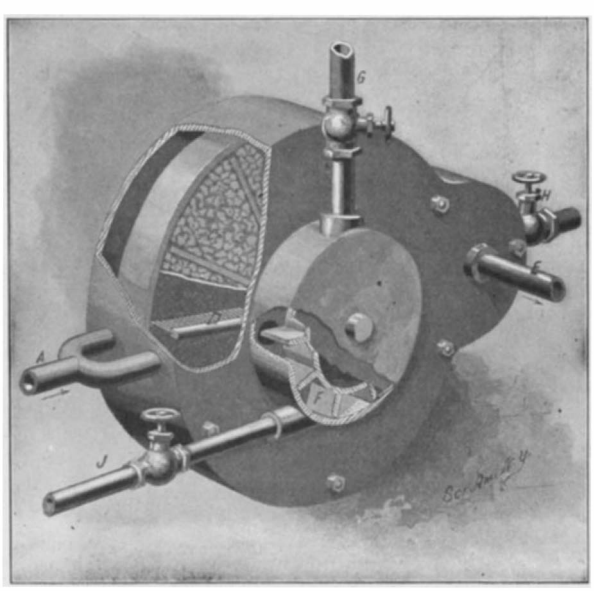
Under date of August 21, 1901, Consul-General Hughes, of Coburg, reports:

The Berlin semi-monthly periodical Der Arbeitsmarkt (The Labor Market) furnishes facts and figures which show that there is a continuous scarcity of work in Germany. From the mining district and from the centers of the iron-working and machine-making regions, short hours, dismissals of hands, and the cutting down of wages are reported. In the month of July, 1900, when the depression of business in general was felt for the first time on the labor market, the decrease of employed laborers amounted to only 3 per cent, while in July of this year their already much reduced number has decreased by a further 3 per cent. There is a marked increase in the number of men applying for work at the public labor offices. In July, 1900, for every 100 open places 122.2 applicants were counted; this year their number has run up to 160.9. The labor offices report an increased rush for places, particularly by metal workers and those employed in the building trade (Bauarbeiter). The latter may hope for an improvement, at least in some places, at the beginning of the autumnal building season, but for the iron workers the outlook is gloomy, indeed.

A NOVEL FILTER.

A simple durable filter that can be readily cleaned without the necessity of removing any part forms the subject of a patent granted to William E. Corlett, of Jennings, Oklahoma Territory.

Within a cylindrical casing a filter, *C*, is mounted, which may be described as a drum, the heads of which are formed of tripoli rock or other filtering material. This drum is divided into a number of radial compartments, which are filled with rock. The water to be filtered is supplied by a pipe, *A*, to the outer cylindrical casing; percolates through the heads of the filtering drum, whereby the coarser impurities are removed; flows through the rock-filled radial compartments; and emerges from the discharge-pipe, *E*, communicating with the drum, as a thoroughly purified stream.



A NEW FILTER.

The coarse impurities that cling to the drum-heads are removed by means of brushes, *D*, carried by a shaft passing loosely through the outer cylindrical casing and the drum. The shaft is driven by a water motor, *F*, which receives its water supply from a valved pipe, *J*, and which discharges the spent water through a pipe, *H*. When the water-motor is driven, the brushes, carried by the motor-shaft, are made to wipe off the material clinging to the drum-heads. The impurities thus brushed off drop to the bottom of the outer cylindrical casing, and can be drawn off by way of a valved discharge. It is therefore evident that the apparatus need not be taken apart to clean the filtering-drum.

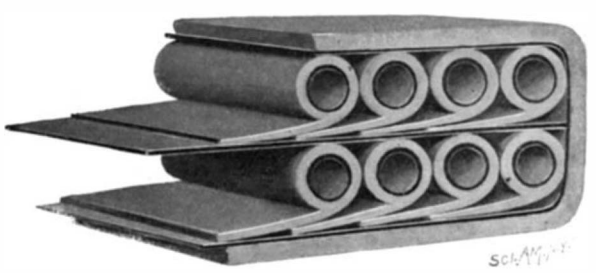
The inclosing shell of the motor communicates with the outer cylindrical casing of the filter by means of a valved opening, so that, by closing the discharge-pipe of the motor, the water ordinarily used for turning the shaft can flow into the outer cylindrical casing of the filter for purification and discharge through the pipe, *E*.

A FIREPROOF PIPE COVERING.

A non-heat conducting and fireproof covering to be used in buildings, steam-fitting and in every other connection in which it is desired to protect one part from heat or fire at another, is the subject of an invention recently patented by Maurice Sullivan, of Corona, N. Y.

The covering consists of a sheet of asbestos rolled to form a tube, but also to leave a tangentially projecting wing, as it were. Upon this projecting portion the tubular covering of another pipe is laid, and upon the projecting sections of this second pipe the tubular casing of a third pipe is laid, and so on. A number of sections can be laid together in the same plane to form a flat, board-like structure, which can be used for walls and other similar structures and buildings. The tubular sections are placed side by side in the manner described, and covered on both sides by a sheet of asbestos or other material. Any number of sections can be joined together to produce a covering of the proper size.

Our illustration shows two layers of pipes to which the covering has been applied. In this arrangement strips of paper are laid next to the tubes, and between the layers; and around the whole is placed a covering of asbestos. These parts are assembled or otherwise secured together to form a rigid and stiff structure.



A FIREPROOF COVERING FOR PIPES.

The covering is also especially useful for columns, between pillars and the like, and also for ceilings, floors, and walls. It is hardly necessary to describe these various applications in detail, since they are more or less similar to the application already described and illustrated.

The Current Supplement.

The current SUPPLEMENT, No. 1345, contains a number of articles of great interest. "Use of Steel in Concrete Construction" is an elaborately illustrated article. "Vanishing Venice" is by Alfredo Melani. "Fatalities of Mountaineering" dscribes serious accidents which have occurred on the mountains of the world. "Methods of Curing Tobacco" is by Milton Whitney, Chief of the Division of Soils. "A Remnant of Buddha's Body" is by Perceval Landon. "The Cluchagne System of Military Rafts and Bridges" describes a new system of floats. "Marine and Estuarine Deposits" is an especially reported lecture by Prof. W. B. Scott. The inaugural address of Prof. A. W. Rücker, President of the British Association, is begun in this issue. "The Steam Coach in 1825" is by R. I. Clegg. "American Locomotives in England" is the sixth in the series.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

RIDING ATTACHMENT FOR WALKING-PLOWS.—EDWARD B. WINTERS, Coffeyville, Kan. This riding attachment consists of opposing plates which can be clamped to opposite sides of a plow-beam, one of the plates being provided with a sleeve, and the other plate having a rack formed at its upper portion. An axle is passed through the sleeve; and through both of the plates an adjusting-lever is attached to the axle to engage the rack. The attachment can be readily adjusted to any form of walking-plow. Either supporting-wheel of the attachment can be raised or lowered to suit the character of the ground and to permit the share to enter the ground to a greater or lesser degree.

Electrical Apparatus.

ELECTRIC ALARM-MAT.—ALBERT D. SHAW, Richmond Hill, Queens, New York city. The mat is adapted to be placed on the floor, above or below carpet or linoleum, and is provided with suitable connections for attachment to electric alarm device. The mat is so constructed that upper and lower metallic elements in circuit connection with the alarm device are normally held out of contact by interposed strips of rubber. The weight of a person is sufficient to produce a contact of the upper and lower elements and complete the circuit connection with the alarm device, when the circuit is not interrupted by an interposed switch.

Apparatus for Special Purposes.

FIRE-EXTINGUISHER.—GEORGE A. SWENSON, Brooklyn, New York city. Mr. Swenson has invented a device for automatically setting into operation a sprinkling apparatus to extinguish a fire in buildings. Briefly stated, the apparatus comprises a source of water supply and an automatically-actuated valve for permitting this water to pass into and through the sprinkling-pipes. If desired, an alarm mechanism can be used in conjunction with the extinguisher.

ACETYLENE-GAS MACHINE.—JOHN W. GREGORY, St. Joseph, Mo. The invention provides a novel form of acetylene-gas apparatus which is automatic in its operation and simple in its construction. New water-supply devices have been invented which have added much to the efficiency of the machine. A frost-proof case for the apparatus is provided, which is probably a new feature in acetylene-machines.

METHOD OF DISPOSING OF THE SPENT LIQUOR IN WOOD-PULP MAKING.—WILLIAM M. STONE, Keeseville, N. Y. The invention relates to the manufacture of wood-pulp by the well-known sulfite process, and the object is to provide a new means for disposing of the spent liquor. The spent liquor is first drawn into a separate receptacle having a discharge nozzle. A current of air or steam is forced through the receptacle, whereby the liquor is completely atomized and dissipated.

EVAPORATING APPARATUS.—OTTOKAR HOFMANN, Argentine, Kas. The invention provides an apparatus for concentrating by evaporation solutions of metallic and alkali salts for the purpose of crystalizing such salts from the solutions in which they are held and of concentrating liquids which are commonly used in the chemical arts. To this end, the inventor has devised a novel evaporating apparatus, which comrises a pan traversed by hot-air tubes serving the purpose of highly heating the solution poured into the pan. The solution is so fed into the pan that it is gradually, though quickly, heated to the temperature of vaporization, and that it emerges from the pan, highly concentrated.

COFFEE OR TEA MAKING APPARATUS.—CHARLES G. and LOUIS P. DUREL, New Orleans, La. The apparatus embodies a water-reservoir having communication with a base in the form of a vessel in which the water is heated, and from which passes a pipe to conduct the boiling water upward and through a can in which the herbs are placed, so as to subject them to the action of the boiling water.

COMPUTING APPARATUS.—HAROLD W. BYRON, Mercersburg, Pa. In 1897 the inventor received a patent for a computing apparatus, which he has now improved. The improvements in question relate to certain spreading devices, which indicate the weight per square foot of a sheet of leather or similar material. In the present invention the spreading devices are constructed in such a manner that they open and close in a longitudinal direction.

Mechanical Devices.

LEATHER-WORKING MACHINE.—FRANK F. CUMMS, Rutland, Vt. The invention relates particularly to improvements in machines for finishing leather straps, reins, and the like. The object of the invention is primarily to provide a machine of simple construction which operates to apply blacking to the edges of the strap, crease the surface, grease the edges and punch holes at desired distances apart.

CRANK MECHANISM.—CHARLES G. HOLMBERG, Woonsocket, S. Dak. The crank mechanism is more especially designed for use on oscillating engines and other machines, and is arranged to avoid dead-center positions. The crank is made in sections, and links connect the inner ends of the sections with each other. Such is the construction that the shaft receives at all times power from two points.

DOG-TRIP FOR PRINTING-PRESSES.—ROBERT NAUMANN, Manhattan, New York city. This dog-trip for platen presses is of such construction that the moment the impression is drawn off by operating the usual throw-off lever, the supply of ink to the distributing rollers, operating over the platen, will be immediately stopped, the ink supply from the fountain being easily set in operation when the throw-off lever is restored to its normal position.

COMPUTING APPARATUS.—HAROLD W. BYRON, Mercersburg, Pa. The invention is an apparatus designed especially for computing the weight per foot of leather, and has for an object, among others, so to combine a device for measuring the total area of the leather, with a weighing-platform arranged in position to receive the leather discharged from such device, and with a computing device having means operated by the platform and hand-operated means arranged for co-operation with the platform-operating means, that the computation can be quickly, accurately, and practically automatically effected.

CLOTH-PILER.—WILLIAM N. DUNN, Martinsburg, W. Va. This new and improved laying or cloth-folding machine is simple and durably constructed, very effective in its operation, and arranged to lay or fold cloth of any desired width or length to insure a proper cutting of trousers or other garments. A carriage is mounted to travel above a table on which the cloth is to be laid or folded. A cloth-roll hanger is revolubly supported from the carriage, means being provided for unwinding the cloth only during a forward travel of the carriage and for turning the cloth-roll hanger during the return travel of the carriage. These means are controlled by the travel of the carriage.

MOTOR-BICYCLE.—EMIL F. HAFELFINGER, Weehawken, N. J. The object of the invention is to provide a motor-bicycle in which the parts are all assembled so that little space is required. In order to secure this compactness, the inventor has devised a special form of bicycle-frame which comprises a vertical brace having a socket section for the seat-post and a series of arms extended downwardly from the socket section. These arms are curved outwardly between their ends and are arranged one pair forward of the other pair. Between these arms the motor is supported.

DISPLAY-RACK.—ANDREW TODD, Piedmont, O. The rack is used for displaying and handling garments, such as coats, vests and the like. In tailor-shops and clothing-stores, it is the practice to fold coats with the lining outward, and to place them in piles. When it is desired to remove a coat, it is taken hold of and drawn out, by which operation all of the coats in the pile are more or less disarranged. The present invention provides a simple mechanical device in which a number of coats can be placed in a pile closely together, any one of which coats can be removed without disarranging the others.

JACK.—JOHN A. JOHNSON, Hoquiam, Wash. The lifting-jack has a lever with a ratchet-like gear to raise the bar. The improvement lies in the form of the lever and its arrangement with respect to the gear that acts on the bar.

LEMON-SQUEEZER.—PAUL F. SMITH, Denver, Col. The principal feature of the invention is a strainer serving to receive and contain the pits, which strainer is held by a member, spring-actuated normally to lie sidewise from the squeezing devices. Immediately after the lemon has been squeezed, the strainer is released, whereupon it is moved sidewise and the rind of the fruit conveniently dropped into any desired receptacle.

Railway Contrivances.

TRACK-RAIL CONNECTION.—WILLIAM M. DONAHUE, Lindsey, Pa. Mr. Donahue has devised a novel track-rail connection for holding the adjacent ends of track-rails properly alined, which connection affords simple and trustworthy means to compensate for the expansion and contraction of such rails, and also maintain the joint-connections secured against side strains that are liable to displace the rails at their connections.

RAILROAD-CAR VENTILATING APPARATUS.—FRANK L. JOBSON, Richmond, Va. The air gathered from the motion of the train passes into the open mouth of a funnel-shaped hood on the end of the car, and is there utilized in actuating a fan, operating as the motor of an attached suction-fan with blades, so constructed and adapted, as to draw in and force fresh air into and through a filtering, cleansing, and temperature-regulating chamber, where it is rendered pure and sanitary, by the removal of all floating dust, cinders, and noxious gases.

Tools.

GLASS-CUTTER.—JOHN W. TESTER, Minneapolis, Minn. The glass-cutter is of the small type which is constantly used by glaziers. The implement comprises a bottom-plate, at right angles to which is a guide-plate. These parts together are provided with an L-shaped slot for use as an anchorage for engaging a centering arm in combination with a cutting-tool. Among the many merits of the device are durability, lightness, simplicity, cheapness, and the fact that several distinct tools are harmoniously combined in a single instrument.

Miscellaneous Inventions.

BOOT-HEEL.—CHARLES E. KELLER, Los Angeles, Cal. A rubber cushion is arranged in such a manner that the full benefit of the cushion effect is derived, and at the same time the rubber is protected from contact with the earth and securely held in place, forming a compact and durable heel.

PAPER HOLDER.—HENRY R. SMITH, Stamford, Conn. This device is arranged to hold a pad of paper conveniently in position on the inclined surface of a telephone-desk. The need for an invention of this kind has undoubtedly often been felt. The present device is simple and cheap, so that it can easily be manufactured, and will dispense with the usual cord whereby a pad of paper is but very inadequately held.

METAL HOSE-COUPLING AND WASHER.—FRANCISCO D. JOY, Glendora, Cal. The invention is an improvement in that class of hose-couplings employed for connecting different sections of hose with each other or with a hydrant or tank. The improvement relates particularly to the construction of the coupling proper and the washer used therewith, whereby when the washer is placed in position it will retain it under all ordinary conditions of use and disuse until intentionally removed.

GATE.—ELISHA A., CLAUDE D., and NELSON L. ROUSE, Bozeman, Mont. The purpose of the invention is to provide a simple form of gate, which, when opened, will be carried in a lower vertical position to an upper vertical position, and so to construct the operating mechanism that in stormy weather the gate will be held in either position. A further purpose of the invention is to provide a latch constructed in co-operating sections, both of which are simultaneously operated by a single lever, link, or its equivalent.

BALANCE-SHEET BLOTTER.—FREDERICK F. MULLER, near Cardiff, Ala. The balance-sheet blotter is to be used in making a transfer of figures posted to a ledger, the object being to obtain a perpetual balance and to locate errors in posting without loss of time by checking, or a sheet which is in convenient form to be filed away for future reference. The balance-sheet blotter has a border which may be written or figured upon and a body member of blotting material.

CAN.—JOSEPH W. KOHNEN, Buffalo, N. Y. The can is designed especially for the reception of ashes, garbage, and similar substances. The can is mounted on wheels, so that it can be readily transported from point to point. When the ground is covered by ice or snow, runners can be used, instead of the wheels.

DUPLICATE-WHIST SCORING DEVICE.—GEORGE L. CASTNER, Clarksville, Tenn. The device is designed to take the place of other methods of scoring the game of duplicate-whist. A degree of accuracy offered by no other method now in use is obtained; and the operation of keeping a score is considerably shortened. Without altering its general principles of construction, this device can also be adapted for scoring other kinds of games.

REDUCING-FURNACE.—CHARLES BISHOP, San Francisco, Cal. The reducing-furnace has fireboxes at its opposite sides, and a series of perforated arched plates arranged in the furnace behind the fireboxes. Inclined runways extend below the plates. A settling-tank receives the material from the runways. A bullion-pot is connected with the tank. The heat passes upward through the ore on the arched plates, so that the metal is reduced and flows down into the settling-tank.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

SHOP AND ROAD-TESTING OF DYNAMOS AND MOTORS. A Practical Manual for Test Floor, the Car Barn and the Road. By Eugene C. Parham, M.E., and John C. Shedd, Ph.D. New York: Electrical World and Engineer. 1901. 12mo. Pp. 627. Price $2.50.

The present work is calculated to help the student fresh from the theoretical side of the subject, but unacquainted with shop details, and the so-called practical man who is largely self-taught as to the theory of the machines he handles. From the nature of the case mathematical treatment has been simplified to the last degree, and even the graphical method is but little used. The present is the second edition, and it has been extended so as to include the field of street car equipment and operation. The diagrams are clear and easily understandable.

The magazine Outing for October deserves special notice for the very handsome manner in which it is gotten up, and the many well-known writers on natural history and sport who have contributed to its pages most strongly appeal to any one interested in out-door sports and recreation. There is a very interesting article by W. A. Baillie Graham, who is well known in most parts of the world as a distinguished naturalist and sportsman. Edwyn Sandys writes most interestingly of the different rarities in this country and Canada. John Corbin treats on English and American University Athletics. They are all treated in a clear, clever and intelligent manner. Mr. Casper Whitney is the editor, and is deserving of much credit for the able manner in which he conducts the magazine.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 1438.—For the address of the Riverside Tool Co., manufacturers of files, in New York City.

TURBINES.—Leffel & Co. Springfield, Ohio, U. S. A.

Inquiry No. 1439.—For machinery for making matting and chair seats of bulrushes.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 1440.—For parties to make swedged brass or iron wire handles, round or hexagonal, 3 inches long to taper from 5 or 6 inches to 1-10 of an inch.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 1441.—For manufacturers of hand power broom machines.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 1442.—For manufacturers of stone crushers suitable for country roads.

Gasoline Lamps and Systems. Turner Brass Works, Chicago.

Inquiry No. 1443.—For manufacturers of gas balloons.

"Perfect aluminium solder. Amer. Hdw. Mfg. Co., Ottawa, Ill."

Inquiry No. 1444.—For the manufacturer of the automatic kneading trough invented in Boston.

WANTED.—Good, automatic gear cutter. Chicago Recording Scale Co., Waukegan, Ill.

Inquiry No. 1445.—For manufacturers of shooting gallery supplies.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 1446.—For the address of the Eureka Doorholder Company.

For Sheet Brass Stamping and small Castings, write Badger Brass Mfg. Co., Kenosha, Wis.

Inquiry No. 1447.—For manufacturers of novelties.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 1448.—For manufacturers of a packed stuffing box that will remain tight under rotary motion.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 1449.—For manufacturers of horse-shoe machinery.

Kester Electric Mf'g Co's, Self-fluxing solder saves labor, strong non-corrosive joints, without acid, Chicago, Ill.

Inquiry No. 1450.—For manufacturers or patentees of sewing machine motors; spring motors preferred.

MANUFACTURERS! Want any parts made of any metal? Write us. Metal Stamping Company, Niagara Falls, N. Y.

Inquiry No. 1451.—For address of the manufacturer of a one-horse lawn mower with guards and knives like ordinary mowing machines, but with cutting bar running behind or before the wheels, like the old Eureka machine.

Automobiles built to drawings and special work done promptly. The Garvin Machine Co., 149 Varick, cor. Spring Streets, New York.

Inquiry No. 1452.—For manufacturers of cooking kettles, with water jacket or steam heating device, for cooking food for cattle.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 1453.—For manufacturers of electrical supplies, novelties, machinery, etc.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 1454.—For manufacturers of stills for burning charcoal and making wood alcohol.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 1455.—For manufacturers of anti-rust compound to be applied cold and not destroy polish.

Gentleman established over twenty years in Paris, and well acquainted with the trade there, wishes to represent a few American first-class manufacturers in France. Address with full particulars France, Box 773, N. Y.

Inquiry No. 1456.—For manufacturers of fish net machinery.

An all round mechanic of long experience, as millwright and general repairer—metal and wood—able to construct and work out ideas of others, will be open to engagement November 1. Excellent references. F. W. Jensen, 508 Second Avenue, Long Island City.

Inquiry No. 1457.—For manufacturers of broom machinery.

REPRESENTATION FOR HOLLAND.—Well established, leading Rotterdam firm, with travelers covering Holland and large connections, wants the sole representation of iron and woodworking machinery or tools. First class references. Cash in advance, if desired. Apply "Iron," care of Filiaal Nederl. Kiosken Maatschappij, 55 Eland Straat, The Hague, Holland.

Inquiry No. 1458.—For manufacturers of double automatic relief check valves

WANTED.—First class draftsman on marine engine work. Gas Engine and Power Co. and Charles L. Seabury & Co., Cons., Morris Heights, New York City.

Inquiry No. 1459.—For manufacturers of duplophones and polyphones,

Inquiry No. 1460.—For manufacturers of chemical laboratory supplies.

Inquiry No. 1461.—For manufacturers of small castings for dynamos from 10 to 50 volts.

Inquiry No. 1462.—For parties to manufacture pen holders having hard rubber ferrule, aluminium ferrule, cedar stem and cork covering for the aluminium ferrule.

Inquiry No. 1463.—For manufacturers of all kinds of bent wood.

Inquiry No. 1464.—For machinery for the manufacture of pulp from waste wood. Also information regarding same.

Inquiry No. 1465.—For manufacturers of round hardwood handles 1 inch by 4 feet long.

Inquiry No. 1466.—For parties who build "The Figure 8 Coasters" and other novelties for summer resorts

Inquiry No. 1467.—For manufacturers of gas engines for electric generators of 15 or 18 h. p.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8376) A. D. writes: I want to make a small alternating current induction motor of ¼ or ½ horse power, and I would like a little assistance in regard to the winding, frame, armature, etc. Can you refer me to anything that will aid me? A. The plans for a single-phase induction motor of ¼ horse power can be found in "Electrical Designs," price $2 by mail. The same book contains plans for a great variety of electrical apparatus.

(8377) C. M. N. writes: A 75-kilowatt Warren alternator seems to cause a hum in the wattmeters in this town, and I wish to learn the best means of preventing the same. The more lamps that are turned on the louder the hum, but there is a hum sufficiently loud to disturb people in sleeping apartments of private residences even when no lamps are on and meter is not operating. A. The humming sound is produced by the current itself, and is the musical tone corresponding to the number of alternations of the current per second. It can be heard on all alternating circuits, and particularly well in an arc lamp when the arc is long. It is produced by vibrations set up by the current. Of course, the wattmeter is not concerned in producing the sound, for you state that it is heard when the wattmeter is cut out.

(8378) W. H. De W. says: Will you please send me the formula for liquid to etch on steel? I want the one that saw manufacturers use on their saws. I have never seen it printed in the Query columns of the SCIENTIFIC AMERICAN, and would like very much to have the receipt. A. For etching brands and marks on polished steel surfaces, such as saws, knife blades, and tools, where there are many pieces to be done alike, procure a rubber stamp with the required design made so that the letters and figures that are to be bitten by the acid shall be depressed in the stamp. Have a plain border around the design, large enough to allow a little border of common putty to be laid around the edge of the stamped design to receive the acid. For ink, use resin, lard, oil, turpentine, and lampblack. To ¼ pound of resin put 1 teaspoonful lard oil; melt, and stir in a tablespoonful of lampblack; thoroughly mix, and add enough turpentine to make it of the consistency of printer's ink when cold. Use this on the stamp in the same manner as when stamping with ink. When the plate is stamped, place a little border of common putty around and on the edge of the stamped ground. Then pour within the border enough acid mixture to cover the figure, and let it stand a few moments, according to the depth required, then pour the acid off. Rinse the surface with clean water; take off the putty border, and clean off the ink with turpentine. Use care not to spill the acid over the polished part of the article. For the acid, 1 part nitric acid, 1 part hydrochloric acid, to 10 parts water by measure. If the effervescence seems too active, add more water.

(8379) J. G. B. asks: What causes the humming of telephone and telegraph wires? What is the advantage of the alternating and polyphase currents over the direct current? The humming of wires is due to the vibration of the wires. The vibration is caused principally by the friction of the wind. It is cured by an instrument called an anti-hum, which consists of a spring to take up the vibration. These currents admit of transformation by static transformers. Hence a high voltage can be employed upon the line and be changed to the voltages suitable for the service at the point where it is needed. A finer wire can thus be used in transmission and saving be effected in the price of many parts of the installation.

(8380) A. C. A. asks: 1. What would be the best material to use for the armature of a helix? A. Iron is the only material of any value whatever as the armature of an electromagnet. 2. What size wire and how much shall I use to get the strongest pull—2-inch movement, using eight dry cells? A. We do not know what you wish to do, nor what current you have to do it with, but a motion of two inches is very large for any ordinary electric power to produce. The size of wire depends entirely upon the quantity of current which is to flow through it. 3. About what internal resistance has the average dry cell? A. All degrees of resistance from a few ohms up to a very large number of ohms, according to the condition of the cell.

(8381) C. M. writes: 1. As per instructions in one of Sloane's Electrical Library, I made some chloride of silver battery cells in test tubes, using a saturated solution of ammonia chloride and sealing the tubes thoroughly with paraffin wax. The cells were made several days ago and give a good current; in fact, they are all I would desire as a battery cell. But they are in such a nasty condition, ammonia chloride creeping all over the tubes and connections in spite of all the care I took to seal them. Can you suggest any other solution that would answer as well? A. Ammonic chloride is a salt which creeps very badly, and is difficult to control. The glass tubes should be paraffined before they are used for perhaps an inch from the top, both on the inside and outside. Then fill them and seal with paraffine. 2. Please tell me why the zinc is amalgamated. A. Zinc is amalgamated to render it the equivalent of chemically pure zinc by stopping the local action to which commercial zinc is subject. 3. Would it be of any advantage to fuse the silver chloride? A. Yes.

(8382) O. H. H. asks: Does ice melt faster in a cool, damp cellar or in a warm, dry room? Have had different opinions on the same and would like to know the correct one. A. The melting of a substance is proportional to the difference of temperature between that substance and the place where it is. There is no connection between the melting of ice and the moisture of the place where it is, or rather the place where ice is kept will soon be saturated with moisture, since ice evaporates at all temperatures without becoming liquid. Ice will for these reasons melt better in a warm place than in a cool place.

(8383) W. G. A. asks: You would confer a favor by giving me any information which you may have necessary for the making of metal signs by electrolysis of copper deposit on wood or plaster patterns, the treatment of such non-conductors necessary to make the copper adhere to the surface, making them waterproof. A. The process you desire is that of electroplating upon wood and other non-conductors. The form is first made exactly as it is desired to be in the finished article. It is then covered with plumbago to render it a conductor, and afterward covered with copper in an electroplating bath. SCIENTIFIC AMERICAN SUPPLEMENT Nos. 310, 1190, and 1204, price ten cents each, contain instructions for this work.

(8384) P. W. S. asks: 1. I wish to install a 1 horse power dynamo and storage battery in cheapest manner. Can direct current at 25 volts be transformed to 110 volts? If possible, would it be best to have dynamo and battery of 25 volts' capacity and transform it to 110 for the light circuit? A. To transform a direct current from one voltage to another it is necessary to use the current to run a motor, this motor to turn a dynamo which is wound to deliver current at the new voltage required. This arrangement is called a rotary converter. It is an expensive method. 2. Wouldn't the battery for 25 volts be cheaper than one for 110? A. Yes. A battery should have one-half as many cells as the voltage of the circuit. For 25 volts, 13 cells are needed; for 110 volts, 55 cells are needed. 3. If it couldn't be transformed, would it be best to have lamps and all at 25 volts? A. If your needs are small it would be better to use a battery and light the lamps directly. Battery lamps can be purchased for low voltages. 4. Is there some way of using the osmium lamp mentioned in SCIENTIFIC AMERICAN, August 10? Give information or address to get such. A. We do not know that these lamps are yet upon the market.

(8385) J. M. A. asks: I have two electric line circuits. One is 3 feet long and another 1,000 feet long, of No. 8 copper wire, each of 98 per cent conductivity. I run a current of 100 amperes through each circuit. Which of the two circuits would the temperature of the wire (taken at any point of the two circuits) be the greatest? A. In the short circuit. The heat produced by a circuit is expressed by the symbol C^2R, or by the square of the amperes multiplied by the resistance in ohms. There is more heat generated in the longer wire, but it also is able to radiate more heat because of its larger surface. Hence the shorter wire will become the hotter.

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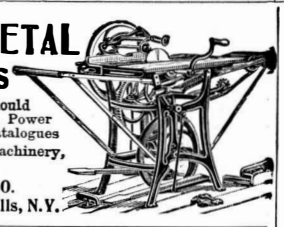

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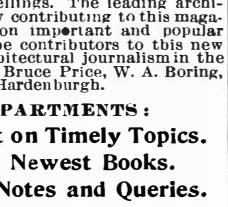

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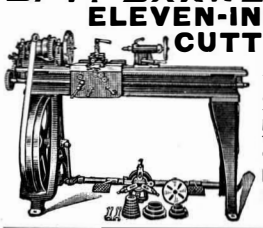

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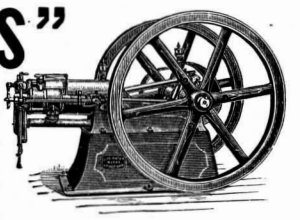

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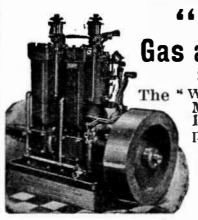

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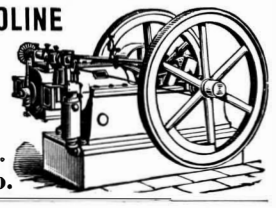

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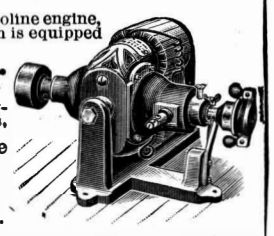

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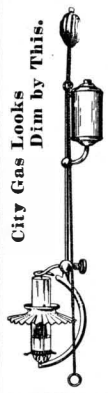

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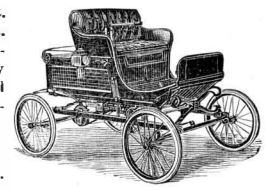

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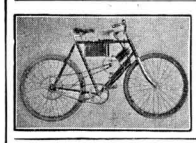

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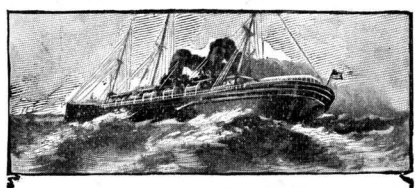

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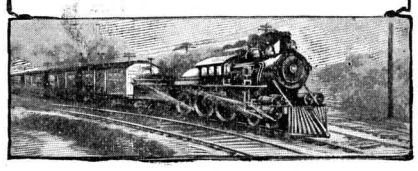

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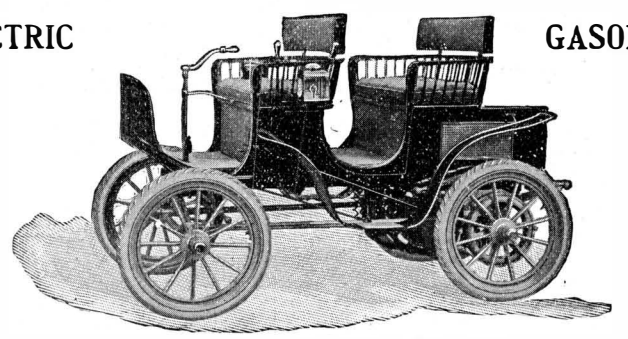

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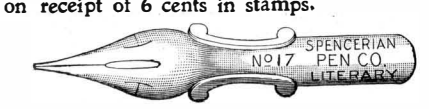
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